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MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY }
LUDLOW GRISCOM } Associate Editors
STUART KIMBALL HARRIS }

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SOME RELATIONSHIPS OF THE FLORA OF THE CUMBERLAND PLATEAU AND CUMBERLAND MOUNTAINS IN KENTUCKY

E. LUCY BRAUN

BOTANIZING in eastern Kentucky is particularly interesting because of the element of surprise which is introduced from time to time by the finding of totally unexpected plants. That part of the state to the east and south of the Blue Grass is in the Appalachian Plateaus Province,¹ made up of the Allegheny Plateau northward and the Cumberland Plateau southward (drainage basins of Kentucky and Cumberland rivers) with maximum elevations from about 1200 feet on the west to about 2000 feet on the east; and the much more rugged Cumberland Mountains in the extreme southeastern part of the state (Fig. 1).

It will be noted that this Cumberland Mountain section is separated from the Blue Ridge Province—commonly called the Southern Appalachians—by the broad strip of longitudinal valleys and ridges comprising the Ridge and Valley Province. Furthermore, it does not attain the altitude of that Province, the maximum elevation being slightly over 4000 feet.

The flora to be expected in eastern Kentucky is that of the Alleghenies generally. Because of geographical location, Kentucky is a meeting place of northern and southern Allegheny species. We expect, hence, to find white pine and magnolias, for instance, but we do not expect the extreme northern forms which extend south in the

¹ Physiographic provinces after Fenneman (1928).

higher mountains (at least we do not expect them at low elevations); neither do we expect to find in the plateaus and mountains any considerable number of plants from the Coastal Plain; nor, because of the separation from the Blue Ridge Province, typical Southern Appalachian species in any quantity. Yet all of these groups of species do occur.

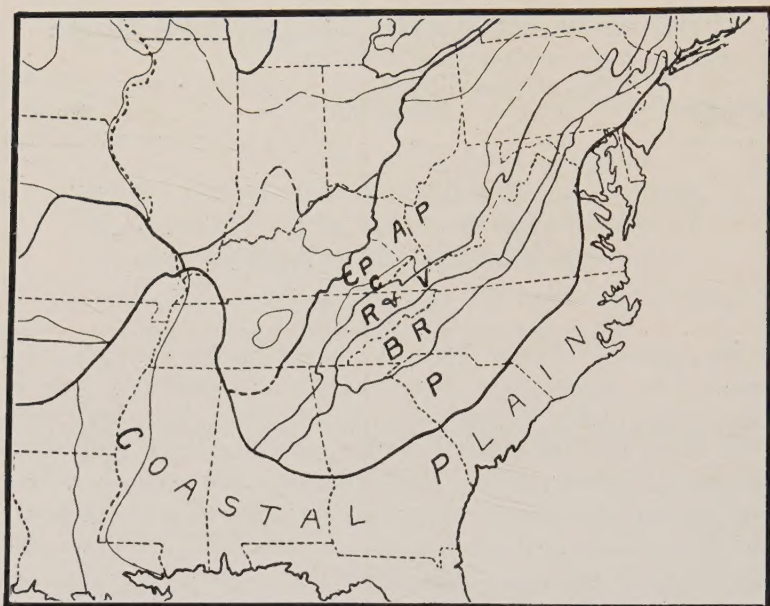
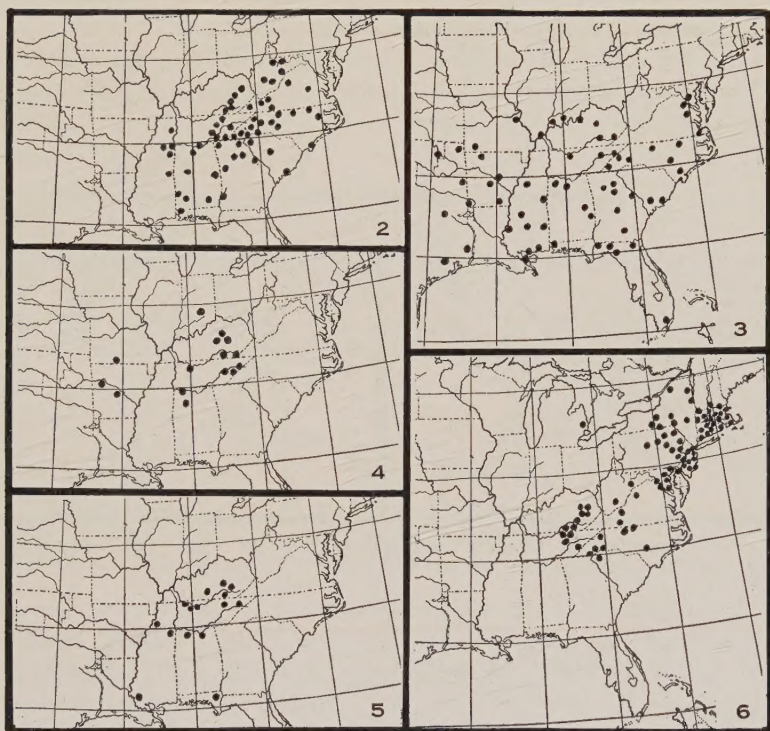


FIG. 1. Map showing boundaries of physiographic provinces and sections: Coastal Plain; Piedmont (P); Blue Ridge (BR); Ridge and Valley Province, (R&V); Appalachian Plateaus Province, made up of the Allegheny Plateau (AP); the Cumberland Plateau (CP), and the Cumberland Mountains (C). After Fenneman.

The intraneous flora of eastern Kentucky is made up chiefly of widespread species whose ranges generally include this area, of Appalachian species of wide range such as *Zanthorhiza apiifolia* L'Her. (FIG. 2), and of southern species at or near their northern limits as *Arisaema quinatum* (Nutt.) Schott, *Magnolia macrophylla* Michx., *Galactia volubilis* (L.) Britton, *Jussiaea decurrens* (Walt.) DC. (FIG. 3), *Aralia spinosa* L., *Bignonia capreolata* L., *Elephantopus tomentosus* L., *Coreopsis auriculata* L., and *Helenium tenuifolium* Nutt. Another group of intraneous species of interior or southern-interior

range,¹ is represented by *Trautvetteria caroliniensis* (Walt.) Vail, *Hypericum dolabriforme* Vent., *Cladrastis lutea* (Michx.) Koch (Fig. 4), *Polygala Curtissii* A. Gray, *Meehania cordata* (Nutt.) Britton. A few northern species extend southward into this area, as *Pinus Strobus* and *Betula lutea* Michx.; others occur as disjuncts and are best con-



FIGS. 2-6. Distribution of intraneous Species: (2) *JUSSIEA DECURRENS*; (3) *ZANTHORHIZA APIIFOLIA*; (4) *CLADRASTIS LUTEA*, Appalachian and Ozarkian; (5) *PACHYSANDRA PROCUMBENS*, local; (6) *LYGODIUM PALMATUM*.

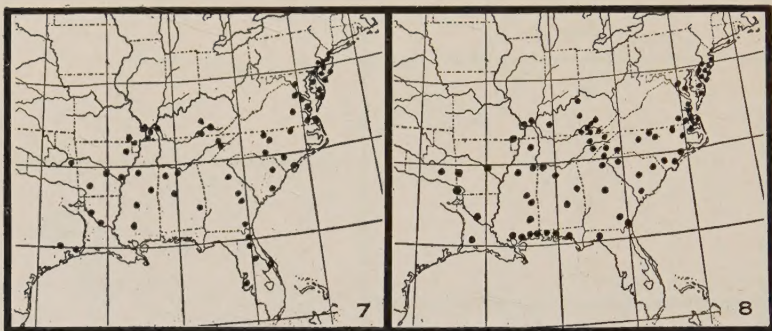
sidered with the extraneous flora. Western species are almost lacking, unless the grasses, *Andropogon furcatus* Muhl., *A. scoparius* Michx., *Sorghastrum nutans* (L.) Nash, be so considered, or the flora of disturbed areas be included (for example, *Croton monanthogynus* Michx.). In addition, there are a few extremely rare endemics—*Conradina vert-*

¹ Some of these species are what Steyermark (1934) designates as species common to both the Southern Appalachians and Ozark Plateau.

icillata Jennings (*C. montana* Small)¹ and *Silphium brachiatum* Gattinger²—and some localized species more or less abundant on the Cumberland Plateau, as *Pachysandra procumbens* Michx. (FIG. 5), *Lygodium palmatum* (Bernh.) Sw.³ (FIG. 6) and *Gaylussacia brachycera* (Michx.) Gray.⁴

The extraneous species are of particular interest for they give some clues to the probable vegetational history of the area.

The Coastal Plain element is especially well represented on the Cumberland Plateau, particularly near its western margin; and much less pronounced, though present, on Pine Mountain in the Cumberlandlands. One Coastal Plain tree, *Quercus phellos* L. (FIG. 7) is an im-



FIGS. 7, 8. Species ranging through the Coastal Plain and Mississippi Embayment, with interior upland stations: (7) *QUERCUS PHELLOS*; (8) *ITEA VIRGINICA*.

portant species of certain swamp forests of Whitley County. Among the grasses are *Andropogon glomeratus* (Walt.) B. S. P., *Erianthus alopecuroides* (L.) Ell. (*E. divaricatus*), *Aristida affinis* (Schult.) Kunth (*A. palustris*), *Uniola laxa* (L.) B. S. P. and *Panicum longifolium* Torr.,⁵ the first in two stations, each of the others in one on the Cumberland Plateau. *Pogonia (Cleistes) divaricata* (L.) R. Br. (FIG. 10), which Fernald (1931) considers "a typical species of the Coastal

¹ Known from Clear Fork River, Fentress and Morgan counties, Tennessee (Jennison, 1935) and from South Fork Cumberland River, McCreary County, Kentucky (Braun, 1936).

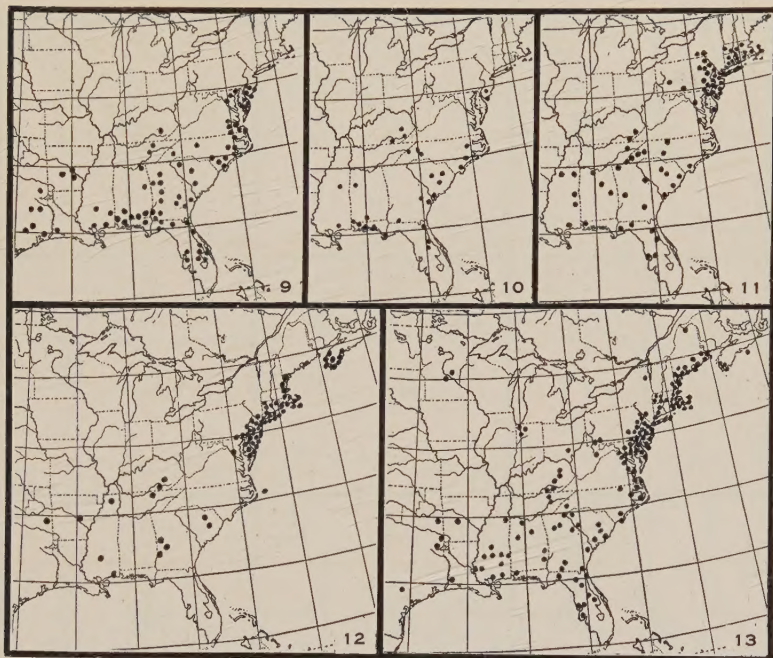
² Recorded by Small (1933) from "Appalachian Plateau, Tenn." and by Braun (1936) from Clay County, Ky.

³ These upland stations considered by Fernald (1931) as relic colonies of a tropical genus.

⁴ For map of distribution of this species, see Wherry (1934).

⁵ The identification of these grasses verified by A. S. Hitchcock or Mrs. Chase. For ranges, see Hitchcock (1935).

Plain, and well known from high tablelands of the Southern Appalachians," is found near the headwaters of the Cumberland River between Pine and Black Mountain at 1700 feet (in Letcher County) and at the westernmost margin of the Cumberland Plateau in Wolfe



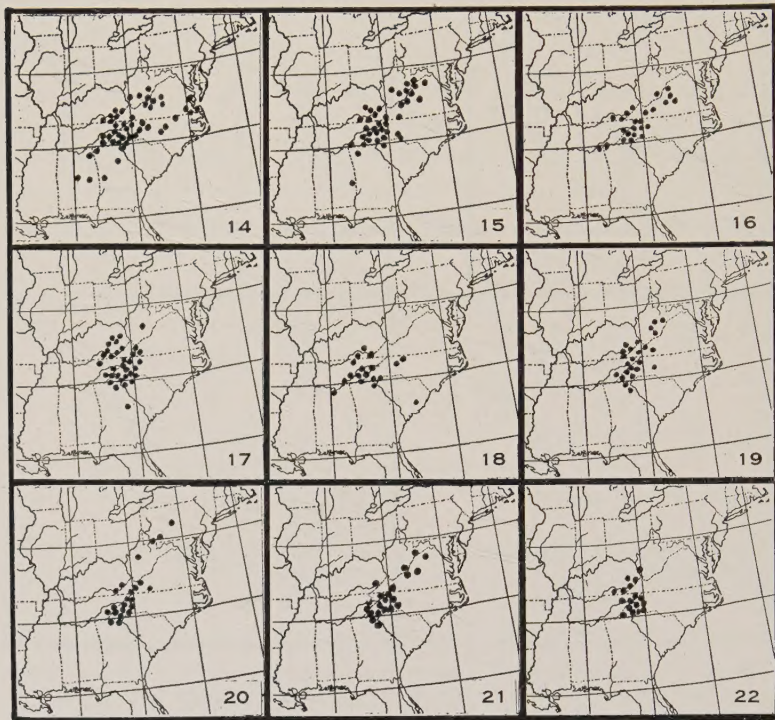
FIGS. 9-13. Coastal Plain species: (9) *GRATIOLA PILOSA*, (10) *POGONIA DIVARICATA*, representative Coastal Plain species with upland occurrences only southward; (11) *ORONTIUM AQUATICUM*, (12) *BARTONIA PANICULATA*,¹ (13) *VIOLA PRIMULIFOLIA*, representative Coastal Plain species with upland occurrences southward and in New England.

County and more commonly in McCreary County on sandstone knobs or monadnocks of the undissected portions of the plateau, which are remnants of the Cumberland Peneplain. All three stations are far removed from the Coastal Plain and from the Southern Appalachians. *Schwalbea australis* Pennell² is another Coastal Plain species found

¹ *BARTONIA*, so far as known, confined to the Coastal Plain in the South, except for one station on the Ozark Plateau and three stations close to one another at the western edge of the Cumberland Plateau. Map shows distribution of *B. PANICULATA*, including *B. LANCEOLATA*, but omitting the northern varieties *SABULONENSIS*, *IODANDRA* and *INTERMEDIA*.

² Identified by F. W. Pennell. For distribution, see Pennell, 1935.

with *Cleistes* on these monadnocks of the Cumberland Plateau in McCreary County, and one which is a pronounced disjunct. *Cyperus retrofractus* (L.) Torr. is also here. The Coastal Plain *Itea virginica* L. (FIG. 8) is a dominant shrub in many a swamp near stream head-

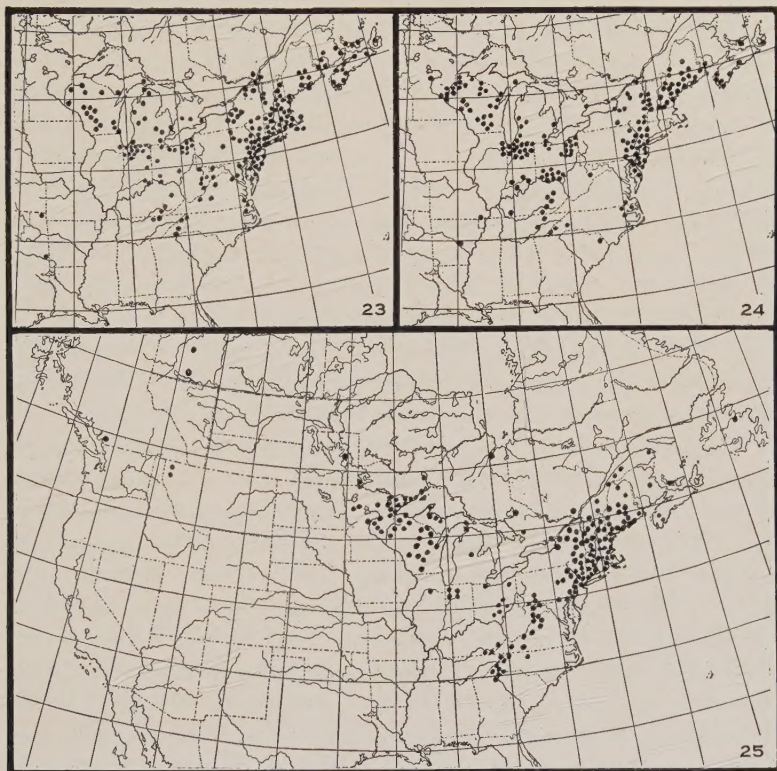


FIGS. 14-22. Southern Appalachian species: (14) *GALAX APHYLLA*; (15) *CAMPANULA DIVARICATA*; (16) *RHODODENDRON CATAWBIENSE*; (17) *CLETHRA ACUMINATA*; (18) *STEWARTIA PENTAGYNA*; (19) *MAGNOLIA FRASERI*; (20) *HOUSTONIA SERPYLLIFOLIA*; (21) *SAXIFRAGA LEUCANTHEMIFOLIA*; (22) *ASTILBE BITERNATA*.

waters on the Cumberland Plateau; *Viola primulifolia* L. (FIG. 13) is almost always found in the same situations. *Bartonia paniculata* (Michx.) Robinson (FIG. 12) in two stations in Sphagnum cushions; *Ascyrum stans* Michx., *Gratiola pilosa* Michx. (FIG. 9) and *Lobelia Nuttallii* R. & S.¹ in wet meadows are other Coastal Plain species that may be mentioned for the Cumberland Plateau. *Orontium aquaticum*

¹ For map of distribution of *Lobelia Nuttallii* see McVaugh (1936).

L. (FIG. 11); typically Coastal Plain but known from a few stations in the mountains of Pennsylvania, North Carolina and Tennessee, is on Pine Mountain in southeastern Kentucky, in Bell and Letcher counties. These are only some of the Coastal Plain species, a very



FIGS. 23–25. Northern species of general distribution northward: (23) *RUBUS HISPIDUS*; (24) *SPIRAEA TOMENTOSA* (including var. *ROSEA*); (25) *CORYDALIS SEMPERVIRENS* (Alaska stations not shown).

fair proportion of which have not hitherto been known from the area under consideration.¹ Ten of these plants were found together in one small area of swamp woods and wet meadow in Laurel County (Braun, 1937).

Typically Southern Appalachian species are more often found in the Cumberland Mountains—either on Black Mountain or on Pine

¹ Some stations recorded by Braun, 1936.

Mountain—than on the Cumberland Plateau, though they are represented there on the *western* margin. Southern Appalachian species in the Cumberland Mountains are *Anemone lancifolia* Pursh, *Cymophyllus* (Carr.) *Fraseri* (Andr.) Mackenzie, *Magnolia Fraseri* Walt. (FIG. 19) in coves, lower slopes and on rocky summits, *Gentiana decora* Pollard, *Saxifraga leucanthemifolia* Michx. (FIG. 22), *Monotropsis odorata* Ell., and *Houstonia serpyllifolia* Michx. (FIG. 20) as low as 1600 feet. On the Cumberland Plateau only (near Cumberland Falls) is *Boykinia aconitifolia*. A few species occur in both areas—the Cumberland Mountains and the *western edge* of the Cumberland Plateau. Among these are *Astilbe biternata* (Vent.) Britton, *Galax aphylla* L., *Campanula divaricata* Michx., *Stewartia pentagyna* L'Her., *Clethra acuminata* Michx. and *Rhododendron catawbiense* Michx. (FIGS. 14–22). The last named species, *Rhododendron catawbiense*, grows in separated stations practically throughout the entire length of Pine Mountain at about 3000 feet elevation, and on a cliff-margin at 1200 feet in McCreary County at the western edge of the Plateau and fifty miles removed from the nearest part of Pine Mountain.

Northern forms are few in the Plateau sections, though *Viola rotundifolia* Michx. (FIG. 29) is common in many stations, and *Claytonia caroliniana* Michx. (FIG. 26) only slightly less so; *Rubus hispidus* L. (FIG. 23), *Spiraea tomentosa* L. (FIG. 24) and *Pyrus melanocarpa* (Michx.) Willd. are present in swamps (the latter also on rocky summits). *Myrica asplenifolia* L. and *Solidago racemosa* Greene¹ occur in one river-bank station. *Taxus canadensis* Marsh. is known from one station in the Allegheny Plateau in northern Kentucky (in Carter County) but does not occur on the Cumberland Plateau. In the Cumberland Mountains, one is surprised to find *Oxalis montana* Raf. (American *Oxalis Acetosella*) (FIG. 27) which the most recent of our manuals states grows in “cold damp woods, Blue Ridge and more northern provinces, N. C. to Tenn., Man. and N. Sc.” (Small, 1933). Here it grows in several stations: on Black Mountain at 3500 feet, and as low as 1800 feet on Pine Mountain. More surprising still is the occurrence of this plant in the Allegheny Plateau at an elevation of only 700 feet on the Little Sandy River in Elliott County. *Trillium undulatum* Willd. (FIG. 30), called by Small a “typically northern type of Trillium” and said to grow in damp woods and bogs, is found in the Cumberlands in three stations: at 4000 ft. on Black Mountain in

¹ Identified by M. L. Fernald.

a chestnut forest with an ericaceous understory, and on Pine Mountain, at 1800 and 2200 feet, under hemlocks. Other northern species found in the Cumberland Mountains are *Circaea alpina* L., as low as 1600 feet in the Cumberland Valley; *Luzula saltuensis* Fernald, on Black Mountain in Letcher County at about 2000 feet; *Streptopus roseus* var. *perspectus* Fassett,¹ on north slopes of Black Mountain in Harlan County at 3500 feet; *Corydalis sempervirens* (L.) Pers. (FIG. 25) on sandstone outcrops along Pine Mountain in Bell, Harlan, and Letcher counties; and *Acer pensylvanicum* L. (FIG. 28), abundant on Pine and Black Mountain.

That this may not become a mere enumeration of species, I have omitted many of the less striking examples of the several groups of species.

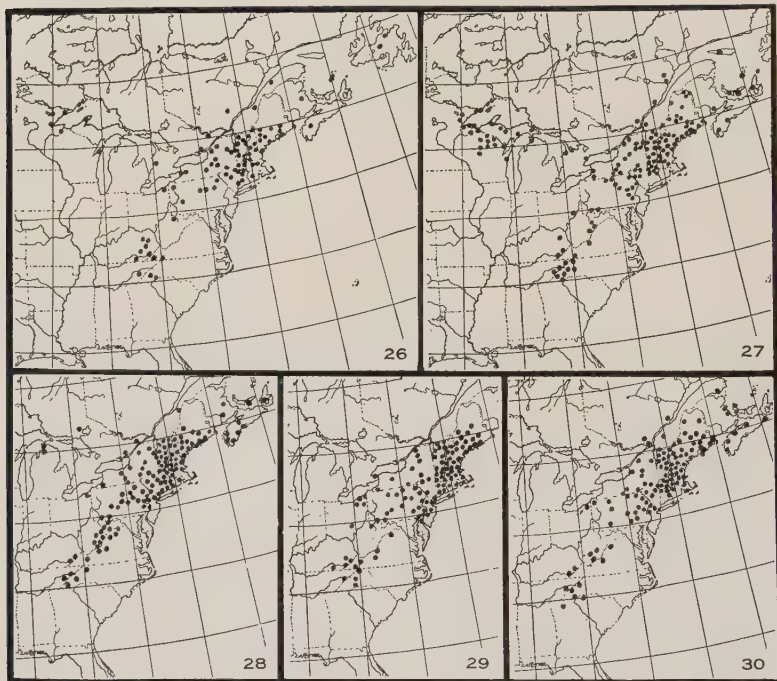
Are these observed occurrences a matter of chance, of random distribution, or have they been brought about by changing conditions in more recent geological time? Seldom do we find a more perfect example of the inter-relations of species-distribution and geological history. Hence, for explanation of the occurrences noted we must turn to the physiographic history of the area.

The ancient Paleozoic land-area of eastern North America was base-leveled, perhaps a number of times. Base-leveling favors mesophytes and swamp plants, and greatly restricts plants of cliffs and rocky summits. The last base-level which was general over this area—except for certain monadnocks—was that known as the Schooley or Cumberland Peneplain. This has been called the "Cretaceous Peneplain," but physiographers now date it as "not older than Miocene" (fide Fenneman).

At this time we may conceive, then, of a low-lying land-mass of slight relief on which meandered sluggish streams. In places there were hills, where the base-level was incomplete, or even remnants of ledges, if very resistant rocks underlaid slopes as must have been the case along the western outcrop of the Pottsville—now the western margin of the Cumberland Plateau. Too, narrower valleys or slightly steeper protected slopes would be present where streams of the gently undulating peneplain crossed the margin of resistant rocks. This slight diversity of topography would have been a feature of the western outcrop of the Pottsville sandstone. The mountains of the southern Blue Ridge Province—the Southern Appalachians—were but very

¹ For the distribution of this species and its varieties, see Fassett, 1935.

incompletely base-leveled, in fact remained in almost mountainous condition, and to this it is generally agreed they owe in large part their relic-endemic flora. In southeastern Kentucky, "Pine Mountain may have constituted a low swell, several hundred feet high which, when followed longitudinally rose and fell mildly, or was subdivided into



FIGS. 26-30. Species of the northern Great Lakes region and New England, with isolated stations in the Appalachian region southward: (26) *CLAYTONIA CAROLINIANA* (exclusive of Rocky Mountain stations); (27) *OXALIS MONTANA*. Northern species whose distribution centers in New England, with isolated stations in the mountains southward: (28) *ACER PENSYLVANICUM*; (29) *VIOLA ROTUNDIFOLIA*; (30) *TRILLIUM UNDULATUM*.

long elliptical embossments."¹ That is, where the rugged Pine Mountain now is there was then a series of hills held by the superior hardness of the rock (the Pottsville sandstone). The higher Black Mountain, too, was represented by monadnocks on the Schooley or Cumberland Peneplain, due to another resistant sandstone.

¹ For certain data on the physiography of this section, the writer is indebted to Dr N. M. Fenneman for the privilege of reading a portion of the manuscript of his book, "Physiography of the Eastern United States."

These several features introduced diversity into the vegetation of the peneplain. Mesophytic forest prevailed. Swamp plants and plants of poorly drained sandy flats found favorable environment along the sluggish old-age streams and on the reduced uplands between the streams. On the sheltered slopes of monadnocks, in less open valleys crossing resistant rocks, and in hillier places generally the most mesophytic of species found favorable retreats. On the few exposed summits and ledges—as the upturned strata of Pine Mountain¹ and the monadnocks of the western Pottsville border—plants of dry sandy soil or cliffs persisted.

Picture this peneplain uplifted and streams given renewed cutting power. The flora of the plain suffered most, and retreated before the changing environment, moving outward onto the emerging Coastal Plain, and perhaps in part northward where uplift was less pronounced, but not without leaving remnants behind it—the present relic colonies of what are now considered Coastal Plain species. In these relic colonies are often a few somewhat northern species as *Spiraea tomentosa*, *Pyrus melanocarpa* and *Rubus hispidus* (FIGS. 23, 24), which may represent the flora which moved northward off the elevating peneplain.

“The present Cumberland peneplain is not definitely known to be anything else than the eroded and reduced Schooley peneplain, though it is regarded by some physiographers as a younger and lower peneplain itself elevated and dissected later.” In its *western* (and more typical) part, it is submaturely dissected by physiographically young valleys. “Its former character is seen in its broad remnants of a surface in which only shallow valleys of an older generation are found.”² It is underlain by the strong resistant Pottsville sandstone, here some 600 or 700 feet thick, and the immaturity is due in part to this.

Let us examine now the distribution of the extraneous species in the light of physiographic history.

The present known distribution of most of the Coastal Plain plants in the Cumberland Plateau coincides with the undissected remnants of the Schooley or Cumberland peneplain. Here they occupy swamps and wet meadows at the headwaters of unrejuvenated streams (cf. *Andropogon*, *Erianthus*, *Aristida*, *Uniola*, *Itea*, *Ascyrum*, *Bartonia*, *Gratiola*, *Lobelia*, *Viola*) or occur on the low knobs or monadnocks (*Cleistes*, *Schwalbea*, *Cyperus retrofractus*). A few are sometimes

¹ For vegetation and structure of Pine Mountain see Braun, 1935.

² Fenneman, Mss., loc. cit.

found along streams cut into the plateau (*Itea*, *Diodia teres* Walt., *Gymnopogon ambiguus* (Michx.) B. S. P.), or even extend a short distance westward (downstream) from the plateau (*Itea*). The relic *Orontium* on Pine Mountain occupies, in one station, a swamp on an unrejuvenated mountain summit stream, in the other, a valley swamp at the foot of the mountain.

The Coastal Plain element is of particular interest. Two possible explanations present themselves: (1) that the Coastal Plain species now on the Cumberland Plateau have migrated into this area since the development of the distinctive Coastal Plain flora; or (2) that the Coastal Plain species of the Cumberland Plateau are relics, and that they occupied this area before and during the development of the distinctive Coastal Plain flora, a part of which was then derived from the Appalachian highlands. While the two explanations are diametrically opposed, it is possible that both are in part correct, that the occurrence of certain species may be explained in one way, of other species in the other way. *Itea virginica* and *Quercus phellos* (Figs. 7, 8), which alone of the species discussed are found in the Mississippi embayment region of western Kentucky, may have migrated from the Coastal Plain upstream onto the Plateau. The occurrence of the other species on undissected remnants of the plateau or on monadnocks and their wide separation from the general area of their ranges, point to the relic interpretation. Furthermore, the localization of a dozen or more of Coastal Plain species in a single swamp (in Laurel County) but a few acres in extent (Braun, 1937) and the absence of most of these species from other stations (so far as yet ascertained) is difficult to explain on a basis of recent migration. The association of northern plants (*Spiraea*, *Rubus*, *Pyrus*) with these, and their physiographic location (on undissected portions of the Cumberland peneplain) indicate ancient occupancy much restricted. Late Tertiary or early Pleistocene segregation of floras, coincident upon changing climates and dissection accompanying the elevation of the peneplain, resulted in migrations northward of those species which later became "northern" species, and southward of those which have become "coastal plain" species.

The southern Appalachian element is made up of species whose general range is that of the southern Blue Ridge Province, that great area which was very incompletely base-leveled. These may be thought of as representatives of ancient genera whose formerly more wide-

spread distribution became greatly curtailed by the time of maximum development of the Cumberland or Schooley peneplain. If the distribution of these species is related to this event in the physiographic history of the Appalachian highlands, then at least some of them should occur in other areas whose history was similar to that of the southern Blue Ridge, and in which diversity of topography was maintained. In the Cumberland Mountains there were monadnocks; along the western margin of the Cumberland Plateau the nature of the underlying rock made highly probable a certain topographic diversity even on the peneplain. In these two places Southern Appalachian species do occur. They are well represented in the Cumberland Mountains by high mountain species (*Saxifraga leucanthemifolia*, *Houstonia serpyllifolia*, FIGS. 20, 21); and in the Cumberland Mountains and along the rugged western margin of the Cumberland Plateau (by *Clethra*, *Galax*, *Stewartia*, *Astilbe*, *Campanula divaricata*, and *Rhododendron catawbiense*, FIGS. 14-18, 22). That is, these southern Appalachian forms belonging to the most ancient genera, and whose ranges were restricted by peneplanation, now occur as relics on all or part of the former monadnock areas but not elsewhere.

The northern element is made up of species of general northern range (FIGS. 23-25) which reach their southern limits here or are uncommon southward, and of species growing in the north or northeast and in the higher mountains southward (FIGS. 26-30). As far as range and habitat in the southern mountains are concerned there is usually little difference between this latter group of northern plants and certain Southern Appalachian species (cf. *Saxifraga leucanthemifolia*, *Houstonia serpyllifolia*, FIGS. 20, 21).

The range of the northern species is in part at least a result of post-Pleistocene migrations, for all northern stations were attained in this way. Stations southward of the limits of glaciation may be interpreted in either of two ways: (1) they may be relics of a more southern range brought about by southward migrations during the Pleistocene; or (2) they may be still more ancient, relic southern stations of species which, during the final segregation of northern and southern types in late Tertiary or early Pleistocene time, became the northern flora. If the present range is the result of Pleistocene and post-Pleistocene migrations, the species should be expected at higher elevations or in relic boreal habitats. This is not true of most of the northern species in the Cumberland Mountains. If the present range is the result of

late Tertiary segregation followed by post-Pleistocene northward expansion of range, the species should be expected, in the south, in physiographically old regions, *i. e.*, in regions where base-leveling was not attained, and might well be in company with species of southern range rather than in relic boreal habitats. This is true of most of the northern species in the Cumberland Mountains and Cumberland and Allegheny Plateaus—in only one place is there any suggestion of grouping of northern species, and even here distinctly Southern Appalachian species are present also.¹ Northern and Coastal Plain species also occur side by side.

Even if altitudinal limits of forest types had been lowered considerably during the Glacial Epoch, there would still have remained numerous breaks in continuity of the mountains, where valleys intervene. If it is postulated that the Pleistocene southward migration of northern forest vegetation was so great as to completely occupy the mountains, it would be difficult to reconcile the present coincident occurrence of northern species with Southern Appalachian and Coastal Plain species. The finding of spruce and fir pollen in a bog in northeastern Tennessee (Sears, 1935) need not be taken as infallible evidence of a great southward swing of northern forests. Mountain summits of the Cumberlands, though today without spruce or fir, are so close to the elevation at which these trees (especially spruce) are to be expected, that their once higher summits may have had them. It is not difficult to conceive of sufficient lowering of altitudinal limits as to permit spruce-fir summit forest more extensive than in the Great Smoky Mountains today. It is difficult to conceive of southward movement of a spruce-fir forest to Tennessee, *without displacing all extremely southern and Coastal Plain species*. If these were displaced, their presence now could be explained only by recent migrations, migrations into occupied territory. But the time has not been long enough to account for their return to the isolated stations in which they now occur.

SUMMARY AND CONCLUSIONS

As interpreted here, the flora of the Cumberland Plateau and Cumberland Mountains in Kentucky displays strong southern affinities, indicated by (1) the large proportion of species of southern range in the intraneous flora, (2) the Southern Appalachian species, and (3) the Coastal Plain species. Northern species are present and are

¹ On Pine Mountain, in southeastern Kentucky. See Braun, 1935.

interpreted as representing survival from the undifferentiated Tertiary flora. The affinities with the Southern Appalachian or Blue Ridge flora are so striking as to indicate that the Cumberland Mountains are floristically a part of the Southern Appalachians, though they are physiographically isolated by the valleys of the Ridge and Valley Province. This relationship is correlated with physiographic history, which was similar in the two regions, both of which escaped complete peneplanation.

The perfect accord between distribution of disjunct species and location of physiographically old situations—monadnocks, undissected parts of peneplains, unrejuvenated streams and undrained plateau swamps—supports the interpretation of species-distribution based on a known sequence of physiographic events.

ACKNOWLEDGEMENTS

The distribution-maps in this paper are based upon data secured from the Gray Herbarium, the herbaria of the New York Botanical Garden and the Academy of Natural Sciences of Philadelphia, to the officers of which the writer is indebted. In a few instances, where the picture of distribution thus gained was erroneous either because of lack of data from states in the more westerly part of the ranges or because certain Gulf Coastal Plain species thus mapped appeared more frequent in the Appalachian highlands (where every station is probably represented by a specimen) than on the Coastal Plain (from which fewer specimens of common plants reach the larger eastern herbaria), additional data were taken from sources here noted. Additional Ohio records are taken from Schaffner, Revised catalog of Ohio Vascular plants (1932); additional Indiana records of shrubs, from Deam, Shrubs of Indiana (1932); additional records for Mississippi from Lowe, Plants of Mississippi (1921); and for Alabama from Mohr, Plant life of Alabama (1901). To Dr. F. K. Butters of the University of Minnesota, Mr. C. C. Deam of Bluffton, Indiana, Dr. J. H. Ehlers of the University of Michigan, Dr. Norman C. Fassett of the University of Wisconsin, Dr. Hazel Schmoll of the Field Museum, Chicago, and Dr. J. H. Schaffner of Ohio State University, the writer is indebted for additional data from their respective states.

The Kentucky records are based chiefly upon the collections of the writer. The herbaria of the University of Kentucky and of the Kentucky Agricultural Experiment Station were examined by the writer for any additional county records contained therein.

To the American Association for the Advancement of Science and to the National Research Council grateful acknowledgement is made of grants received for aid in field work.

THE UNIVERSITY OF CINCINNATI,
Cincinnati, Ohio.

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TWO RARE WEEDS.—While exploring in the vicinity of the Wyman Dam at Moscow, Maine, on August 21, 1934, the writer found a crucifer growing on the fill above the dam which did not seem to belong to any of the species with which he was familiar. A specimen was submitted to Mr. C. A. Weatherby of the Gray Herbarium who identified it as *DESCURAINIA HARTWEGIANA* (Fourn.) Britton. This plant does not appear in the herbarium of the New England Botanical Club and is in the Gray Herbarium only from the West and from Canada



Photo. E. C. Ogden.

PERICOME GLANDULOSA, n. sp.: FIG. 1, TYPE, $\times \frac{2}{5}$.
P. CAUDATA: FIG. 2, leaves, $\times \frac{2}{5}$, from El Paso County, Colorado, C. S. Sheldon.

where it is a native. There is one report of this plant in New England, cited in the "Additions to the Flora of Connecticut," Hartford, 1930, as found in Waterbury, Connecticut.

On September 5, 1936, Mr. C. H. Knowlton and the writer were renewing acquaintance with the area of South Boston near the Fish Pier and the Freight Yards where unusual weeds have been found from time to time. In a vacant lot where evidently wool-waste had been thrown out, a strange plant was found which appeared to belong to the Chenopodiaceae but was entirely unfamiliar. Mr. Weatherby also identified this plant. It is *BASSIA HYSSOPIFOLIA* (Pall.) Volk, a recently introduced weed from southwestern Asia. It has appeared several times in the western United States and was found in waste ground a few years ago in Worcester.—RALPH C. BEAN, Wakefield, Massachusetts.

A NEW SPECIES OF *PERICOME*

GEORGE J. GOODMAN

(Plate 459)

THE genus *Pericome* has been considered to consist of two species. One, *P. macrocephala* Robinson, from Durango, Mexico, is very distinct, known, to the writer at least, only by the type collection. The other, *P. caudata* Gray, the type species of the genus, is fairly common in herbaria. In the North American Flora, its range is given as "Western Texas to southern Colorado, Nevada, southern California, and Chihuahua." The west end of the Oklahoma panhandle is not so far from this range, but the genus *Pericome* has not been reported heretofore from that state.

The relationship of the new species is with *P. caudata*, but the following description indicates its distinctness.

Pericome glandulosa, sp. nov. (TAB. 459, FIG. 1), herbacea perennis, 1 m. vel plus alta; caulibus ramosis, teretibus, striatis, glandulosis, puberulentibus; petiolis circiter 1 cm. longis, laminis late ovatis vel cordatis, integris vel subintegris, acuminatis, 2-3, raro 4, cm. longis, subtus glandulosis et dense scabro-puberulentibus, supra aliquid minus, palmate 3-5-costatis; inflorescentiis corymboso-cymosis, terminalibus, capitulis pluribus, pedunculis 1-2 cm. longis, involucris turbinato-campanulatis, 5-6 mm. altis, dense glanduloso-puberulentibus, bracteis circiter 20, breviter acuminatis; corollae tubo $1\frac{1}{2}$ mm. longo, faucibus 3 mm. longis; achaeniis anguste oblongis, circiter

3½ mm. longis, sparse strigillosis, marginibus callosis, dense hirsuto-ciliatis; pappi squamis laceratis, 1 mm. vel minus longis.

Pericome glandulosa, n. sp. Perennial herbs a meter or more tall; stems branched, terete and striate, glandular and puberulent; petioles about 1 cm. long, leaf-blades broadly ovate to cordate, entire or nearly so, acuminate, 2-3, or rarely 4 cm. long, glandular and densely rough-puberulent beneath, somewhat less so above, palmately 3-5-ribbed; inflorescence of several-headed terminal corymbose cymes, peduncles 1-2 cm. long; involucre turbinate-campanulate, 5-6 mm. high, densely glandular-puberulent, bracts about 20, short-acuminate; corolla-tube 1½ mm. long, throat 3 mm. long; achenes narrowly oblong, about 3½ mm. long, sparsely strigillose on the faces, densely hirsute-ciliate on the calloused margins; lacerate scales of pappus a little less than 1 mm. long.—At foot of rock cliffs, 3 miles east of Kenton, Cimarron County, OKLAHOMA, August 27, 1934, *Goodman*, No. 2291, TYPE in the Gray Herbarium. ISOTYPE material may be found in the herbaria of the University of Oklahoma, Iowa State College, Missouri Botanical Garden, and elsewhere.

In summary, the new species is readily recognizable by the glandular pubescence, and by the leaves, which are shorter (2-3, rarely 4, cm. long) than are those of *P. caudata* (5-10 cm. long), and cordate, rarely deltoid, and by no means so caudate, characteristic leaves of *P. caudata* being shown as FIG. 2.

IOWA STATE COLLEGE, Ames, Iowa.

MONOGRAPHIC STUDIES IN THE GENUS ELEOCHARIS. IV¹

H. K. SVENSON

(Plates 460-465)

1. Series: TENUISSIMAE²

THIS series, primarily of dwarf tropical plants (MAP 1) inhabiting especially the sandy coastal plain of southeastern United States, the pine lands of western Cuba, and the warmer parts of South America, is also well represented in tropical Africa and in Madagascar; otherwise (except for the widespread *Eleocharis*³, series *Chaetariae* of

¹ Brooklyn Botanic Garden Contributions, No. 75. The cost of the plates is met by the Brooklyn Botanic Garden.—Eds.

² See RHODORA xxxi. 129 (1929).

³ Since no definite ruling has as yet been made I continue here the original spelling ELEOCHARIS instead of HELEOCHARIS. The confusion resulting from the latter spelling has already been mentioned by me (see footnote, RHODORA xxxi. 123 (1929)).

India and the Malay region) it is practically unknown in the Orient and is entirely lacking in Australia. In general, the diminutive size of the plants, the small trigonous achenes (except in *E. minima* var. *bicolor*) and usually punctate quadrangular-sulcate culms, make the group fairly well-defined. The nucleus is formed by the *Tenuissimae* C. B. Clarke, Kew Bull. Add. Ser. viii. 106 (1908), but the *Chaetariae* (l. c.) are intertwined and are not clearly separable. Through the transitional species, *E. retroflexa* and *E. tortilis*, the series has its culmination in *E. tuberculosa*, of larger stature than the other



MAP 1. Range of *ELEOCHARIS*, series *TENUISSIMAE*.

species, and characterized by a remarkable development of the style-base. *E. melanocarpa* probably belongs near the *E. Baldwinii-E. vivipara* group, but the relationship is obscure, and I have preferred to include it in the miscellaneous species, treated after the *Tenuissimae* in this paper. The *Tenuissimae* articulate through *E. sulcata* with a series of generally coarser plants, often with prominently elongated rootstocks and with larger achenes (ser. *SULCATAE*), well represented in Argentina and southern Brazil, including *E. pachystyla*, *E. pachycarpa*, *E. grandis*, *E. Niederleinii*, and, to me, a tangle of other species.

The smaller members of the *Tenuissimae* (especially *E. minima*, *E. nigrescens*, and *E. microcarpa*) have been the source of much confusion and misinterpretation, and in order firmly to establish the

synonymy of these obscure species, I have often found it desirable to illustrate (from the type specimen, whenever possible) the plants representing each name. These illustrations have been made by Miss MAUD H. PURDY, artist for the Brooklyn Botanic Garden. It may be added that the small species (and most of the larger species) of *Eleocharis* must be examined with a good binocular microscope. Magnifications of $30\times$ and $54\times$ have been found most satisfactory.

In the dwarf species of the *Tenuissimae*, and nowhere else in the genus, sessile basal spikelets are of frequent occurrence. These are found at the culm-bases, often so abundantly as to form scaly bulb-like masses. Each spikelet is 1-flowered, developing a single achene which is usually a little larger than the achenes produced in the normal spikelets (cf. PL. 465, FIG. 10). Similar basal spikelets have been described by Chermeson¹ in three Madagascar species of *Scirpus*, and are known also in several South African species of *Bulbostylis* (cf. *B. striatella*, Thistleton-Dyer, Fl. Cap. vii. 206 (1898)), and in the Mexican *Scirpus heterocarpus* Wats. Such spikelets, according to Chermeson, are perhaps the result of alternate immersion and emersion.

Work on this group has progressed intermittently over a period of years, and I have therefore had opportunity to study these particularly difficult species at leisure. Through the kindness of Dr. Merrill and Dr. Gleason of the New York Botanical Garden, I was able to examine the entire rich *Eleocharis* collection of that institution; to Professor Fernald and Mr. Weatherby of the Gray Herbarium I have also been in constant debt. Other curators of herbaria, both in this country and abroad, have been generous with time and specimens, as may be seen from the following institutions, in addition to our own (B), from which I have cited specimens:

- | | |
|---|--|
| (Alb)—New York State Museum,
Albany | (K)—Royal Botanic Gardens, Kew |
| (Ber)—University of California at
Berkeley | (NY)—New York Botanical Garden |
| (Cal)—California Academy of Sci-
ences | (Ost)—hb. Cornelio Ostén, Monte-
video, Uruguay |
| (Cam)—Cambridge University | (Ph)—Academy of Natural Sciences,
Philadelphia |
| (Can)—Canadian National Museum | (Pom)—Pomona College |
| (Cop)—Botaniske Museum, Copen-
hagen | (S)—Riksmuseum, Stockholm |
| (D)—Herbarium of C. C. Deam | (St. L)—Missouri Botanical Garden |
| (G)—Gray Herbarium, Harvard
University | (T)—University of Tennessee |
| (I)—University of Illinois | (US)—United States National Her-
barium |
| | (W)—University of Wisconsin |

¹ "Sur quelques *Scirpus* à épillets basicaules," Archives de Bot. Caen Bull. Mens. iii. 193-197 (1929).

The distributional maps, constructed almost wholly from specimens which I have examined, do not adequately represent the dispersal of several species in eastern Brazil, due to the few collections available to me from that area.

KEY TO ELEOCHARIS. SERIES: TENUISSIMAE

(Achene measurements include the style-base (tubercle))

a. NEW WORLD SPECIES. . . . b.

b. Achenes cancellate (i. e. with coarse deep-pitted reticulation) c.

c. Achenes large, 2–3 mm. long (species of United States).

Style-base mitriform, as wide as or wider than the achene. 19. *E. tuberculosa*

Style-base conic-subulate, much narrower than the achene. 18. *E. tortilis*

c. Achenes small to medium-sized, not exceeding 1.3 mm. long (species chiefly tropical) d.

d. Aquatic plants with long stolons; achenes obovate-urceolate, 0.8 mm. long (Brazil) 11. *E. glauca*

d. Plants without long stolons. . . . e.

e. Achenes 1–1.3 mm. long. . . . f.

f. Spikelets narrowly linear (scales only 3–4) (Cuba).

12. *E. alveolata*

f. Spikelets lanceolate to ovate (many-flowered).

Achenes obovate-urceolate, coarsely cancellate; style-base with angles decurrent on achene.

10. *E. retroflexa*

Achenes obovate, finely cancellate; style-base pyramidal, without decurrent angles.

Mature achenes gray to nearly black.

Culms 1–3 dm. high, firm; spikelets linear-cylindric, usually proliferous (s. e. United States) 14. *E. vivipara*

Culms 8–10 cm. high, flaccid; spikelets ovate-oblong (Cuba) 16. *E. grisea*

Mature achenes brownish-iridescent, 1 mm. long (South America) 15. *E. subfoliata*

e. Achenes 0.5–0.8 mm. long, whitish-iridescent when mature.

Achenes 0.5 mm. long; pitting horizontally-elongated (Cuba) 17. *E. minutissima*

Achenes 0.6–0.8 mm. long; pitting circular (Mexico) 8. *E. subcancellata*

b. Achenes smooth to reticulate (not cancellate) g.

g. Achenes biconvex (scattered trigonous achenes usually present) 1. *E. minima* var. *bicolor*

g. Achenes trigonous. . . . h.

h. Achenes medium-sized (0.8–1.3 mm. long) i.

i. Spikelets few (2–6)-flowered, ovate; scales dark purplish-brown (Cuba) 6. *E. oligantha*

i. Spikelets many-flowered (if 2–6-flowered, the spikelets linear).

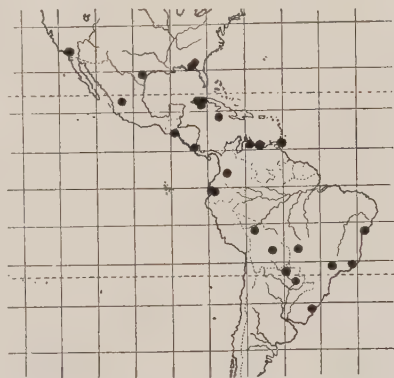
Style-base flat (with an apiculate center), as wide as the achene (Mexico) 2. *E. urceolata*

Style-base conic or pyramidal (if depressed much narrower than the achene).

- Mature achenes glistening-white.
 Scales obviously distichous; achenes lightly
 pitted; style-base higher than broad.5. *E. amazonica*
 Scales not distichous; achene smooth; style-
 base broader than high.4. *E. nana*
 Mature achenes pale gray to deep brown.
 Spikelets obviously distichous.
 Style-base subulate-tipped (s. e. United
 States)13. *E. Baldwinii*
 Style-base pyramidal, obtuse.1. *E. minima*
 Spikelets not distichous.9. *E. microcarpa* var. *filiculmis*
- h. Achenes small.
 Achenes 0.5–0.6 mm. long, white to faint buff, usually
 costulate.
 Style-base pyramidal to depressed-conic, narrower
 than the achene.7. *E. nigrescens*
 Style-base flattened (apiculate in the center), as
 broad as the achene (Argentina)3. *E. Barrosii*
 Achenes 0.6–0.7 (rarely 0.8) mm. long, light gray, not
 costulate.9. *E. microcarpa*
- a. OLD WORLD SPECIES. . . . j.
- j. Achenes cancellate.
 Achenes medium-sized (1–1.5 mm. long).
 Spikelets 1-flowered; much-branched aquatic plant;
 style-base narrower than the achene.26. *E. Naumanniana*
 Spikelets 3–10-flowered; plants caespitose; style-base as
 broad as the achene.20. *E. Chaetaria*
 Achenes small (0.6 mm. long)21. *E. Brainii*
- j. Achenes smooth to reticulate (not cancellate) k.
- k. Culms broad (0.5–1.5 mm. wide in dried material);
 achenes 0.8 mm. long.24. *E. anceps*
- k. Culms capillary to filiform.
 Achenes medium-sized (1.0 mm. long).
 Style-base pyramidal; the angles not decurrent
 (Madagascar)23. *E. caespitosissima*
 Style-base depressed-subulate; the angles decurrent
 on the achene (Senegal)25. *E. trilophus*
 Achenes small (0.5–0.7 mm. long).
 Perianth-bristles present.22. *E. Schweinfurthiana*
 Perianth-bristles lacking.7. *E. nigrescens*

1. *E. MINIMA* Kunth (PL. 460, FIGS. 1, 2, 3, 7; PL. 461, FIG. 1; PL. 465, FIGS. 6–10). MAP 2. Dwarf, 3–7 cm. tall, caespitose, with numerous whitish elongated fibrous roots: culms capillary, often recurving, quadrangular-sulcate, light green, punctate: sheaths conspicuous, light or dark brown, the apex inflated, blunt, hyaline: spikelets 2–4 mm. long, ovate, few- to many-flowered: scales ovate-lanceolate, mostly acute, dark brown with greenish midrib and hyaline margin: style 3-fid: achene ovate, 0.75–1.0 mm. long, sharply triangular with convex faces, whitish to pale or olivaceous brown, lightly reticulate to minutely striate, narrowed at the apex and base, capped by a brownish or gray, short-pyramidal style-base: bristles inconspicuous, transparent-white, obscurely toothed, shorter than the achene, often greatly reduced.—Enum. ii. 139 (1837) [Brazil] [PL. 1, FIG. 7]; Steud. Syn. Cyp. 75 (1855); C. B. Clarke, Bull. Herb. Boiss. ser. 2, iii. 1014 [Pl. Has-

lerianae 236] (1903) and Ill. Cyp. t. xxxii figs. 22–25 (1909); Kükenthal in Fedde, Rep. Spec. Nov. xxiii. 193 (1926); Standley, Field Mus. Publ. Bot. viii. 263 (1931); Ostén, Anales Mus. Nat. Hist. Montevideo, ser. 2a, iii. 176 (1932). *Chaetocyperus polymorphus* Lindley & Nees in Mart. Fl. Bras. ii^l. 94 (1842) (excluding α *depauperatus*) [Brazil]. *Chaetocyperus Jamesoni* Steud. Syn. Cyp. 74 (1855) [Ecuador] [PL. 1, FIG. 2]. *Heliocharis tenuissima* Boeckl. Linnaea xxxvi. 365 (1869–70). *E. Wrightiana* Boeckl. Cyp. Nov. i. 12 (1888) [PL. 1, FIG. 3]; C. B. Clarke in Urb. Symb. Ant. ii. 70 (1900) [Cuba], and in Bull. Herb. Boiss. ser. 2, iii. 1014 [Pl. Hasslerianae 236] (1903). *Eleocharis Durandii* Boeckl. All. Bot. Zeitschr. 1896. 34 (1896) [Costa Rica] [PL. 1, FIG. 1]. *E. oropuchensis* Britton, Bull. Torr. Club xlviii. 327 (1921) [Trinidad] [PL. 2, FIG. 1]. *E. Jamesonii* N. E. Brown in Kew Bull. 1921. 256 (1921).—Texas, California, West Indies, and southward throughout the tropics. TEXAS: in mud and on bark of old wood lying in the mud, Horseshoe Lake, Jackson County, *J. A. Drushel* no. 4153, Aug. 9, 1920 (B, St. L). CALIFORNIA: southern California, *Orcutt* no. 4584 (NY) (distributed as *E. disciformis* Parish). MEXICO: wet places on hills near Guadaluajara, *Pringle* no. 4339 (B, NY) (as *E. subcancellata*). COSTA RICA:



MAP 2. Range of *ELEOCHARIS MINIMA*.

Cañas Gordas, alt. 1100 m., *Pittier* no. 10951, acc. to Clarke, Contr. U. S. Nat. Herb. x. 456 (1908) and Standley, Field Mus. Bot. Ser. viii⁴ 263 (1931). SAN SALVADOR: vic. San Vicente, alt. 350–500 m., *Standley* no. 21174 (NY). CUBA: margin of lagoon near Pinar del Rio, *C. Wright* no. 3369 (TYPE collection of *E. Wrightiana*) (G, NY); Laguna San Matéo, Pinar del Rio City, *Ekman* no. 18250 (S, NY); south of Mendoza, Pinar del Rio, *León & Roca* no. 6950 (NY); Guane, *León & Roca* nos. 7014 (NY), 7015 (NY); San Pedro, Isle of Pines, *Britton & Wilson* no. 15435 (NY) and *Britton, Wilson & Selby* no. 14461 (NY); Las Tunas, *Britton, Britton & Wilson* no. 14739 (G, NY). JAMAICA: Green Island, *Britton & Hollick* no. 2142 (NY). TRINIDAD: Oropuche Lagoon, *Britton, Hazen & Freeman* no. 1155 (TYPE of *E. oropuchensis*, NY); Siparia, *Broadway* no. 7897 (NY). VENEZUELA: Cumana, *Funck* no. 698 (K); Aragua, *Pittier* no. 10159 (NY). COLOMBIA: Neiva, Dept. Huila, alt. 550–600 m., *Rusby & Pennell* no. 1066 (K, NY). ECUADOR: savanna of Guayaquil, *Jameson* no. 369 (K, NY) (TYPE of *E. Jamesonii*); prov. Guayas, alt. 0–100 m., *Hitchcock* no. 20087 (G, K, NY, U). BOLIVIA:

Apolo, 4800 ft., *R. S. Williams* no. 910 (NY); alt. 200 m., Velapo, *O. Kuntze* (K, NY); Buena Vista, Dept. Santa Cruz, *Steinbach* no. 5499 (NY). BRAZIL: Caldas, Minas Geraes, *Regnell* III no. 1307 (coll. *Lindman*) (S); Matto Grosso, *S. Moore* no. 530 (NY); in argillaceo humido, Cuyaba, Matto Grosso, *Malme* in 1902 (S) and 1903 (S); Lagoa, S. José dos Campos, *Löfgren* nb. A359 (S); Santa Cruz, Rio Grande do Sul, *Regnell* II, 1112 (S). PARAGUAY: San Bernardino, *Rojas* no. 1061 (B, ex herb. Ostén); in regione cursus superioris fluminis Apa, *Hassler* no. 8345 (G); prope Puerte Carado, loco saepe inundato, *Regnell* no. A2295 (S); Colonia Risso pr. Rio Apa, *Regnell* no. 1062c (coll. *Lindman*) (S).

This little species of wide range and great abundance in tropical America, was poorly typified by Kunth,¹ who merely gave the indefinite location "Brasilia." My conception of the species, I believe, is much the same as that of Kükenthal (Fedde, Rep. Spec. Nov. xxiii. 193 (1926)) who likewise includes *E. Wrightiana* within the limits of *E. minima*. It comprises plants similar to *Funck's* collection from Cumana, which I examined at Kew, bearing C. B. Clarke's annotation "Compared with the type of Kunth and Boeckeler in h. Berlin." In general the achenes of *E. minima* are olivaceous brown, often fading to a pearly gray, the surface markings varying, as shown in Miss Purdy's drawings, from a light reticulum to an almost indistinguishable series of striations. The style-base is usually as broad as the apex of the achene; in this respect the material from western America (representing *E. Durandii* and *E. Jamesonii*) is especially homogeneous and quite similar to C. B. Clarke's illustration of *E. minima* (l. c.).

The specimen illustrated in PLATE 460, FIG. 7 was determined as *E. minima* by C. B. Clarke, and tends toward the condition seen normally in *E. Wrightiana* and *E. oropuchensis*, both of which have the identical outward appearance of material from western South America (*E. Jamesonii*), and are without question merely narrow-tubercled forms of *E. minima*.² However, great variation in achene and style-

¹ *E. MINIMA*. Perpusilla; caespitosa; culmīs setaceis, basi vaginatis, aphyllis; spica solitaria, ovata, biflora; squamis 4, carinato-navicularibus, ovatis, obtusis, uninerviis, dorso atro-sanguineis, nervo viridi, sub apice evanescente, apice margineque hyalino-albidis, infima vacua; stylo profunde trifido; achenio subrotundo-obovato, trigono, angulis prominulis, laevi, olivaceo, nitido, basi styli abbreviata pallida terminato; setis nullis.—Brasilia.—Planta subsemipollicaris.

² Whether *E. mexicana* Palla (Oesterr. Bot. Zeitsch. lxiii. 402 (1913), from Morelia, Michoacan), based on a collection by Arsène, said to differ from *E. minima* by a larger achene and a style-base "pfriemformig (aufgeweicht schmallanzettlich), spitz, braunlich oder schwartzlich, kaum $\frac{1}{4}$ mm. hoch.", belongs with *E. minima* I do not know, nor have I seen *Schaffner* no. 22 from Mexico upon which Pfeiffer based *E. minima* var. *mcxicensis* (Herbarium, no. 56, 55 (1921)).

base may be found in the same collection (cf. PL. 460, FIG. 2; PL. 465, FIGS. 9, 10, all from *Hitchcock* no. 20087, Ecuador).

Some of the material from southern Brazil, perhaps referable to *E. tenuissima*, has also a higher and narrower style-base than is characteristic of the species throughout the larger part of its range. *E. tenuissima* was a renaming of *Chaetocyperus viviparus* Nees¹ in Mart. Fl Bras. ii¹ 93 (1842), not *Eleocharis vivipara* Link (1821), and the descriptions of both Nees and Boeckeler seem to be based primarily on Sellow's collection from Brazil. A Sellow specimen which I examined at Kew bore the added notation "*Eleocharis exigua* R. & S.?" and is, I believe, merely a form of *E. minima* with loose open spikelets, with achenes sharply angled, light olive-gray, faintly iridescent, smooth to slightly striolate, and with a narrow style-base much as described by Boeckeler "rostro triquetro caryopsi $\frac{1}{2}$ brevior e basi pyramidalis acuminato, fusciscenti." Whether this specimen is the equivalent of Nees' *Chaetocyperus viviparus* I cannot state with certainty, but until further evidence accumulates for separating such material from *E. minima*, I prefer to treat *E. tenuissima* as a synonym of *E. minima*.

At Kew is also a collection from Guadeloupe (*Bertero*) which undoubtedly represents the second collection cited under *E. tenuissima* by Boeckeler. This specimen, which I believe to be a diminutive unfruitful *E. retroflexa*, is the basis of the synonymy "*Eleocharis proliferata* Torrey! and *Heleocharis tenuissima* Boeck!" cited by Clarke under *Eleocharis camptotricha* var. *Schweinitzii*,² and therefore the origin of the tangled thread erroneously carrying "*Eleocharis proliferata* Torr." into South America (cf. Ostén, Anales Mus. Nat. Hist. Montevideo ser. 2^a, iii. 177 (1932). With some hesitation, Clarke identified an immature specimen of *Hassler* no. 3659 (Paraguay) as *E. tenuissima* (cf. Bull. Herb. Boiss. ser. 2, iii. 1016 (1903), an inter-

¹ *Chaetocyperus viviparus* Nees in Martius, Fl. Bras. ii¹. 93 (1842).

² "*Chaetocyperus polymorphus* similis ut formam ejus anomalam credissem, nisi basis rostri dimidii fructus longitudina persistens rostrum conicum referret, quae contra in illo tuberculum depresso-conoideum breve apice mucronulatum refert. . . . In Brasiliae orientalis humidis inundatis legerunt Sellow, Pohl;—in Minarum prov.: M."

² Urban, Symb. Ant. ii. 69 (1900). The chief element in the description of *E. camptotricha* var. *Schweinitzii* was *Northrop* no. 524b which is *E. bahamensis* (see RHODORA xxxi. 230 (1929) and Clarke's annotations accompanying the nondescript specimen in the herbarium of the New York Botanical Garden show that he considered this specimen, quite erroneously, the equivalent of the *Bertero* material from Guadeloupe.

pretation which has further confused the situation in South America.¹ I find material labelled *E. tenuissima* to be generally misidentified, for example, André no. 4279¹, San Sablo (Nova Granata) (G, NY) is *E. retroflexa*, while N. Taylor no. 391, Higuey, Santo Domingo (NY), a proliferous member of the *E. minima*-*E. alveolata* group, is in too poor condition for any determination. In Brazil, *E. minima* seems to pass directly into the aquatic phase known as

Var. AMBIGUA (Steud.) Kükenthal in Fedde, Rep. Spec. Nov. xxiii. 194 (1926) (as to name-bringing synonym only), [see var. *bicolor*]. *Chaetocyperus polymorphus* Lindley & Nees γ^* *natans* Nees in Mart. Fl. Bras. ii¹. 95 (1842). (PL. 460, FIG. 4). *Isolepis ambigua* Steud. Cyp. 91 (1855). *Eleocharis subtilis* Boeckl. Linnaea xxxvi. 426 (1869-70).

The specimen of *Scirpus ambiguus natans*, collected by Salzmann at Bahia, and represented in the Lindley Herbarium at Cambridge, is the sole basis for the names *Chaetocyperus polymorphus* γ *natans* Nees and *Isolepis ambigua* Steud. This collection, examined by me at Cambridge, consists of somewhat distichous-spiked dwarf plants with olivaceous trigonous achenes, the scales darker and more spreading than in *E. nana* with which it has been confused, and quite different from the Trinidad material collected by Crueger (det *E. minima* var. *ambigua* by Kükenthal), referred by me to var. *bicolor*. The illustration (PL. 460, FIG. 4) represents a habit-drawing of Gross no. 20513 (G) from Brazil, which closely resembles the Salzmann specimen, and the achene-drawing is from a sketch made by me from the Salzmann collection at Cambridge. *Chaetocyperus polymorphus* is a well recognized *nomen confusum*,² and the varietal name (i. e. *natans*) is in itself a *nomen subnudum*. *E. subtilis* Boeckl. was based on a Beyrich specimen from Brazil, with achenes described as "*depresso-obovata triangulari, angulis costuliformibus, infra apicem leviter constricta . . . rostro concolorato, perbrevis pyramidato triangulari*," *Scirpus ambiguus natans* being given as a synonym. Beyrich's collection labelled "*Scirpus ambiguus natans*, Bahia, in aquis leviter fluentibus" (and,

¹ The beautiful figures of *H. tenuissima* drawn by Barros, Anales Mus. Hist. Nat. Buenos Aires xxxiv. 452, f. 12 (1928), were probably influenced by C. B. Clarke's determinations, and illustrate a plant with long slender culms, creeping rootstock and thick-tubercled achene, evidently a different thing than the *E. tenuissima* under discussion.

² A "catch all," for small species, comprising, so far as I can interpret, the following elements:

" α *Depauperatus*," based on *Cyperus depauperatus* Vahl = *E. retroflexa*; " α^* *Minimus*," based on *E. minima* Kunth; " β *Sphagnicola*," based on *Scirpus ambiguus sphagnicola* Hb. Lindley = *E. nana*; " γ *Capillaceus*," based on *Scirpus capillaceus* Michx. = *E. acicularis*; " γ^* *Natans*," based on *Scirpus ambiguus natans* Hb. Lindley.

according to C. B. Clarke, representing the type collection), examined by me at Kew, has capillary culms 2–3 dm. high, spikelets 5–6 mm. long, with dark chestnut scales, and unquestionably represents the aquatic phase of *E. minima*. In southern United States and on the island of Trinidad, extraordinary plants are found, in which the majority of achenes are lenticular, representing

Var. **bicolor** (Chapman) n. comb. (PL. 462, FIGS. 1–3). Cespitose, sometimes with slender elongate rootstocks: culms spongy, nearly terete to quadrangular-sulcate, punctate; sheaths stramineous, often a little inflated at the summit, as in typical *E. minima*: spikelets ovoid, 2–4 mm. long, loosely many-flowered: scales 2 mm. long, obtuse to emarginate, with green keel, brown sides and hyaline margin: style 3-fid: *achene obovoid*, 0.7 mm. long, *lenticular* or trigonous, white to stramineous, smooth to lightly reticulate: style-base olivaceous to dark brown, nearly as wide as the achene, flattened-apiculate to short-pyramidal: bristles white, rudimentary to half as long as the achene.—*E. bicolor* Chapman, Fl. S. United States 517 (1860). *Scirpus exiguus* Griseb. Fl. Br. W. Ind. 569 (1864), not HBK. Nov. Gen. et Sp. i. 225 (1816), which is a high Andean representative of *E. acicularis*. *E. subtilis* Clarke in Urb. Symb. Ant. ii. 71 (1900), not Boeckl. *E. Wrightiana* C. B. Clarke, Urb. Symb. Ant. ii. 70 (1900) in part. *E. savannarum* Britton, Bull. Torrey Club xlviii. 327 (1922). *E. minima* var. *ambigua* (Steud.) Kükenthal in Fedde, Rep. Spec. Nov. xxiii. 194 (1926), as to plant cited, not *Isolepis ambigua* Steud. Cyp. 91 (1855). *E. uncialis* Chapman ex Small, Man. 163 (1933) [PL. 3, FIG. 3, triangular achene]. Wet pine barrens, Georgia and Florida; Trinidad. GEORGIA: pine barrens south of Fitzgerald, Irwin County, *R. M. Harper* no. 1711 (NY); wet pine barrens north of Moultrie, Colquitt County, *Harper* no. 1665 (NY). FLORIDA: Quincy, *Chapman* in 1836 (TYPE, NY); damp pine barrens, *Chapman* (TYPE of *E. uncialis*, NY). TRINIDAD: moist hole on the O'Meara Savanna, *Britton* no. 2491 (TYPE of *E. savannarum*, NY); Savanna O'Meara, *Crueger* no. 48 (K).

In the collections of both *E. savannarum* and *E. uncialis*, trigonous and lenticular achenes may be found in the same spikelet, the trigonous achenes being inseparable from those of *E. minima*. *Crueger's* Trinidad specimen at Kew, bearing C. B. Clarke's notation "This was marked by Boeckeler in hb. Berlin *E. Wrightiana* and I think is that," is identical with Britton's type of *E. savannarum*.

2. *E. urceolata* (Liebm.) n. comb. (PL. 460, FIG. 5). Densely cespitose; culms finely capillary, 3–7 cm. high, dull green, punctate and obscurely quadrangular-sulcate; sheaths purplish, a little inflated at the summit; spikelets 2–3 mm. long, ovate (occasionally narrowly oblong and fewer-flowered), 6–11 flowered; scales spreading in fruit, keeled, green with purplish sides and hyaline margins; style 3-fid;

achenes triangular, costulate, 0.8 mm. long, *urceolate-obovate, truncate at the apex*, pale gray to brownish yellow, faintly striate-reticulate to smooth; *style-base flat, apiculate in center*; bristles none.—*Chaetocyperus urceolatus* Liebm. in Vidensk. Selsk. Skr. ser. 5. ii. 243 (1851). *Eleocharis Liebmanniana* Boeckl. Linnaea xxxvi. 439 (1869-70).—MEXICO: savanna swamps, [Hacienda de] Mirador, Potrero de Consoquitla,¹ Liebmann (G, TYPE coll. of *C. urceolatus*); Palmer no. 7069 (G).

Liebmann differentiated *C. urceolatus* from *Chaetocyperus punctatus* Nees (*E. nana* Kunth), but I believe the relationship is closer to *E. nigrescens*.

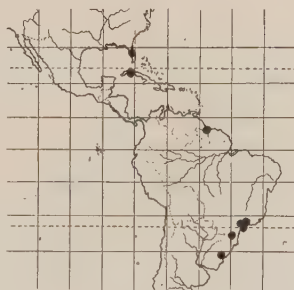
Eleocharis Liebmanniana Boeckl. (based on Liebmann no. 603 from Mirador) was characterized by "caryopsi minutissima . . . angulis prominulis, *tuberculato-rugulosa* albida margaritaceo-nitidula; tuberculo brevissimo conico annulo rugoso circumdato." In reading over Liebmann's text, I find no record that any species of *Eleocharis* other than *Chaetocyperus urceolatus* and the wholly distinct *E. nodulosa* were collected at Mirador, and I believe that *E. Liebmanniana* should, from this fact and the similarity of Boeckeler's description, be placed in the synonymy of *E. urceolatus*. However, I may be wrong in this assumption, for we have not, by any means, solved the tangle of Mexican species associated with *E. nigrescens*. For example, Palmer's no. 294 from Mexico (G) (labeled *E. Liebmanniana*) has grayish achenes 0.8 mm. long, which are strongly cancellate and with prominent costulate angles, evidently not *E. urceolata*. What *Heleocharis aurea* Boeckl. Cyp. Nov. i. 15 (1888) represents I do not know; the collection, from San Luis Potosi, Schaffner no. 212, is said to be related to *E. Torreyana*.

3. *E. Barrosii* n. sp. (PL. 462, FIG. 4), annua, cespitosa, culmis capillaribus tenuibus proliferis *E. minimae* similis; culmis 3-10 cm. longis, obscure sulcatis; vaginis laete brunneis ad apicem paulo inflatis, scariosis; spiculis ovatis, 2-4 mm. longis, subdistichis, laxe paucis vel multifloris; glumis acutis, 2 mm. longis, carinatis, in carina viridis, latere castaneis, margine late hyalinis; stylo 3-fido; achaeniis trigonis, costulatis, obovato-urceolatis, laevibus, 0.6 mm. longis, albidis vel olivaceis, apice truncatis; stylo-basi multo depresso in medio paullo apiculato; setis nullis vel rudimentariis.—ARGENTINA: Formosa, Jørgensen no. 3310 (TYPE in Gray Herb.).

¹ These names do not appear on any maps available to me, but from notations by Liebmann (l. c. p. 207, p. 215, etc.) it is evident that both localities lie in the warm temperate region of the east side of Mexico at an altitude of 3000 and 2500 feet respectively. A specimen of *E. nodulosa* in the Gray Herbarium has the notation "Hidalgo, Mirador."

This clearly distinct little species differs from *E. minima* in having elongated culms and much smaller achenes, truncate at the apex. The achene is also much smaller than in *E. urceolata*. The name is associated with *Dr. Manuel Barros*, the distinguished writer on *Cyperaceae* of Argentina, to whom I am much indebted for helpful information and specimens.

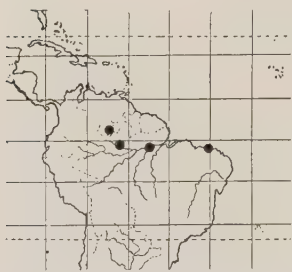
4. *E. NANA* Kunth (PL. 462, FIG. 12). MAP 3. *Erect* caespitose annual (?) with *coarse whitened roots*; culms 4–12 cm. long, glaucous-green, punctate, irregularly sulcate; sheaths stramineous, often marcescent, the apex appressed-acute to somewhat inflated; spikelets ovate to elliptic, 3–4 mm. long, 5–8-flowered; scales greenish to stramineous, keeled, apex and margin hyaline; style 3-fid; *achene sharply trigonous to costate, 1–1.3 mm. long, greenish, becoming pearly when mature, obscurely reticulate*; style-base deep olive to brown, short-pyramidal with an acuminate tip; bristles colorless to light brown, exceeding the achene.—Enum. ii. 140 (1837); Kükenthal in Fedde, Rep. Spec. Nov. xxiii. 193 (1926). *Chaetocyperus punctatus* Nees in Mart. Fl. Bras. ii¹ 93 (1842). *Eleocharis punctata* Boeckl. in Kjöb. Vidensk. Meddel. 1869: 132 (1869–70); Linnaea xxxvi. 420 (1869–70); not *Eleocharis punctata* Hochst. ex Steud. Cyp. 75 (1855) which is *E. sulcata*. *Eleocharis punctata* C. B. Clarke in Urb. Symb. Ant. ii. 69 (1900). *Scirpus camptotrichus* C. Wright in Sauvalle Fl. Cubana 172 (1873). *Eleocharis camptotricha* C. B. Clarke in Urb. Symb. Ant. ii. 69 (1900).—Florida, West Indies, South America. Specimens examined: FLORIDA: bog mat, Lake Lynch marsh, Winter Haven, Polk County, *J. B. McFarlin* no. 3988 (B); cypress swamp, Polk City road, Winter Haven, *McFarlin* no. 5793 (B). CUBA: *C. Wright* no. 3767 (G). BRITISH GUIANA: Penal Settlement, *A. S. Hitchcock* no. 17099 (G, NY); *Jenman* no. 6112 (NY). BRAZIL: *Burchell* no. 3137 (G); Jacarehy, *Dusén* no. 17011 (TYPE coll. of *E. Dusenii* Pfeiff.) (G); Jacarehy, *Dusén*, no 118a (NY); St. Vincente, Prov. S. Paulo, *Mosén* no. 3724 (S); in paludibus, Pirahy, Paraná, *Dusén* no. 3031 (S); Taquerembo, Rio Grande do Sul, *Lindman* no. A1537 (S); Iguape, S. Paulo, *Hochner* no. 24281 (G).



MAP 3. Range of *ELEOCHARIS NANA*.

According to Kükenthal (l. c.) who has examined the type of *E. nana* (*Gaudichaud* no. 3195, Rio de Janeiro), *E. camptotricha* C. B. Clarke and *H. punctata* Boeckl. are synonyms of *E. nana*, which is distinguished from *E. minima* primarily by the taller, more rigid culms and larger achenes.

5. *E. AMAZONICA* C. B. Clarke (Pl. 461, FIG. 9). MAP 4. *Erect* from a slender, much-branched vertical rootstock, *sometimes with slender, elongated rhizomes*; culms 8–10 cm. long, filiform, dull green, wiry, punctate, deeply striate to irregularly sulcate; sheath dull brown, scarious, somewhat acute at the apex; spikelets ovate to lanceolate, 4–7 mm. long, *distichous*, about 10–15-flowered; scales obtuse, thin, appressed, punctate on the



MAP 4. Range of *ELEOCHARIS AMAZONICA*.

obscure greenish keel, light brown to greenish on the sides, with a broad scarious margin, the lower scale greenish, erect, *simulating a continuation of the culm*; style 3-fid; achene obovate, 0.8–1 mm. long, trigonous, *costulate*, *shining white*, smooth to obscurely reticulate; style-base light brown, pyramidal, 1/3 the width of the achene; bristles rudimentary to half as long as the achene, lightly retrorse-toothed.—Kew Bull. Add. Ser. viii. 22 (1908).—BRAZIL: in vicinibus Santarém, Prov. Pará, (*Scirpidium*) (2) *Spruce* in May 1850 (TYPE coll.) (Cop, G, NY), and

in Sept. 1850 (S); ad flumen Guainio v. Rio Negro supra ostium fluminis Casiguari, *Spruce* in 1854 (no. 3757, distributed as *E. polymorpha* Nees (var. ?) (NY); open sandy flats about São Lopez, Fortaleza, Ceará, *Drouot* no. 2454 (G, B). VENEZUELA: Esmeralda, *Tate* no. 258 (juvenile) (NY).

Although of coarser appearance and with wholly different spikelets, *E. amazonica* is nevertheless most closely related to *E. nana*. The latter species has larger, less costulate achenes which have merely a smooth to lightly reticulate surface and are not punctulate as in *E. amazonica*.

6. *E. OLIGANTHA* C. B. Clarke (Pl. 460, FIG. 6). MAP 5. *Dwarf, densely matted*, often proliferous annual; culms finely capillary, 2–5 cm. high, often recurved or prostrate, punctate, quadrangular-sulcate; sheath stramineous to reddish, scarious and slightly inflated at the apex; spikelets 1–3 mm. long, ovate, 2–6-flowered: scales dark purplish-brown, keeled, *spreading in fruit*; style 3-fid; achene 1 mm. long, trigonous, sharply-angled, whitish, becoming gray to dark olive-brown when ripe, faintly punctate-reticulate; style-base usually lighter, pyramidal, acute, somewhat 3-crested at base with overhanging projections; bristles hyaline, obscurely retrorse-toothed, rudimentary to nearly as long as the achene.—Urb. Symb. Ant. ii. 69 (1900); Kükenthal in Fedde, Rep. Spec. Nov. xxiii. 193 (1926). *Scirpus retroflexus* Griseb. Pl. Cub. 239 (1866) and Sauvalle, Fl. Cubana 174 (1873) acc. to Clarke (l. c.). *Heleocharis prolifera* Kükenthal in Fedde, Rep. Spec.

Nov. xxiii. 193 (1926) in part, not Torr.—Muddy places in pinelands and savannas, Cuba. The species was based on *C. Wright* nos. 3367, 3368 in herb. Kew. Specimens examined: Without further location: *C. Wright* nos. 3367 (G, in part), and 3368 (G, NY). PINAR DEL RIO: vic. Pinar del Rio, *Britton*, *Britton & Gager* no. 7234 (NY); *Ekman* no. 17947 (G). ISLE OF PINES: Santa Ana, *Britton & Wilson* no. 15688 (G, NY). SANTA CLARA: El Cumbre, *Ekman* no. 18978 (G, NY); Laguna Pozo Grande, Mordazo, *Ekman* no. 17038 (NY); Sabana de Monasterio, León no. 9216 (NY); Mordazo, León & Cazañas no. 5946 (NY); Manacas, León & Cazañas nos. 5813 (NY) and 5861 (NY); Sabana de Motembo, León no. 11382 (NY); at the mines of Motembo in the water of the crater, *Ekman* no. 16858 (N, S).¹ CAMAGUEY: La Gloria, *Shafer* nos. 293 (NY), 613 (G, NY).



MAP 5. Range of *ELEOCHARIS OLIGANTHA*.

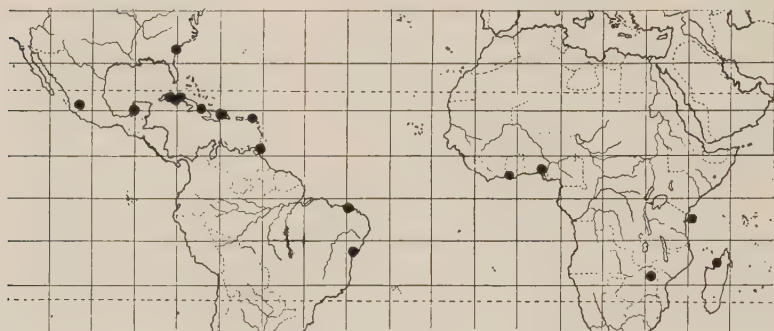
Dr. Kükenthal (l. c.) has differentiated this well marked little species from *E. minima* not only by the shorter and darker scales but also by the wider pyramidal style-base, which, it may be added, usually is 3-pronged at the base.

7. *E. NIGRESCENS* (Nees) Steudel (PL. 462, FIGS. 5, 6, 7). MAP 6. Cespitose annual with fibrous roots, or perennial with lignescent (usually whitened) vertical much-branched rootstocks: culms filiform, erect, 3–7 cm. high, obscurely quadrangular-sulcate, punctate; sheath red (sometimes greenish), the apex marcescent or sometimes projecting into an attenuate appressed appendage 1–2 mm. long; spikelets many-flowered, ovoid, 2–5 mm. long; scales chestnut-brown with a greenish midrib, obtuse to emarginate, scarcely keeled, spreading at maturity; style 3-fid; achenes trigonous, 0.5–0.6 mm. long; the mature achenes² (i. e. those at the base of the spikelet), smooth, semitranslucent, light yellowish brown with prominent costulate whitened opaque angles; immature achenes (or at least those at the middle part of the spikelets) opaque, white, with obscure striolate reticulation and a pearly lustre and with less costulate angles; style-base brown to light gray, pyramidal (or occasionally depressed, acute), 1/3 as wide as the achene; bristles none.—Syn. Cyp. 77 (1855). *Eleocharis nigrescens* Kunth, Enum. ii. 157 (1837) (nomen); C. B. Clarke, Ill. Cyp. t. xxxviii, f. 1–4 (1909); Kükenthal in Fedde, Rep. Spec. Nov. xxiii.

¹ This proliferous specimen, nearly 3 dm. long, was determined by Dr. Kükenthal as *H. prolifera* Torr. It has somewhat the aspect of *Scirpus submersus* C. Wright, but the spikelets and achenes (basal) are typical of *E. oligantha*.

² The achenes are here described from the type collection. Only one stamen was seen in the flowers examined.

194 (1926). *Scirpidium nigrescens* Nees, Linnaea ix. 293 (1843) (nomen) and in Mart. Fl. Bras. iii. 97 (1842). *Isolepis nigrescens* Steud. Syn. Cyp. 91 (1855). *Scirpus microlepis* Grisebach, Cat. Plant. Cubens. 239 (1866). *Helcocharis atropurpurea* var. γ Boeckl. Linnaea xxxvi. 459 (1869-70). *E. Hildebrandtii* Boeckl. Flora lxi. 34 (1878); [Pl. 462, FIG. 6]; C. B. Clarke in Durand & Schinz, Consp. Fl. Afr. v. 598 (1894) and in Thistleton-Dyer, Fl. Trop. Afr. viii. 409 (1902). *E. complanata* Boeckl. Flora 1879. 562 (1879); C. B. Clarke in Durand & Schinz, Consp. Fl. Afr. v. 598 (1894) and in Thistleton-Dyer, Fl. Trop. Afr. viii. 409 (1902); Chermeson, Archives de Bot. Caen iv. Mém. no. 7. 42 (1931). ?*E. Perrieri* Chermeson, Bull. Soc. Bot. France lxxiii. 554 (1926). *E. carolina* Small, Man. S. E. Fl. 165



MAP 6. Range of *ELEOCHARIS NIGRESCENS*.

(1933).—South Carolina to Mexico and Brazil; Tropical Africa and Madagascar. SOUTH CAROLINA: damp pineland soils, Santee Canal, *Ravenel* (NY) (TYPE of *E. carolina* Small). MEXICO: wet places, Guadalajara, *Pringle* no. 2627 (NY). CUBA: south of Guane, Pinar del Rio, *León & Roca* no. 6997 (NY); Oriente, Sabana San Felipe, *Ekman* no. 2408c (NY); *C. Wright* no. 3370 (G, NY) (TYPE coll. of *S. microlepis* Griseb.). SANTO DOMINGO: *Wright, Parry & Brummel* no. 580 (NY). TRINIDAD: *Piarco, Broadway* no. 2143 (B). BRAZIL: Bahia, in maritimis [*Salzmann* (?)] (TYPE in hb. Lindley, Cambridge Univ.); Piauh, *Gardner* no. 2374 (G, NY). ZANZIBAR: *Hildebrandt* no. 1063 (K, COTYPE of *E. Hildebrandtii*); *Kirk* in 1872 (K). ANGLO-EGYPTIAN SUDAN: (southwestern); "Terr. Bongo," *Schweinfurth* no. 2576 (K, COTYPE of *E. complanata*). RHODESIA: *Salisbury*, alt. 4800 ft., *C. K. Brain* no. 8971 (K, B). IVORY COAST: *Districte de Toumode, Chevalier* no. 22376 (K). S. NIGERIA: *Lagos, Dalziel* no. 1297 (K); rice fields, *Barter* no. 1574 (K). MADAGASCAR: *Majunga, Perrier de la Bâthie* no. 17947 (B).

The currently accepted publication of this widespread plant consisted wholly of two *nomina nuda*. Valid publication (as *Scirpidium*

nigrescens), began with Nees in 1842, who cited *Scirpus nigrescens* in Lindley's herbarium, and the first legitimate use of the name *Eleocharis nigrescens* was apparently by Steudel in 1855. The type specimen, so accurately and carefully described by Nees, I have examined through the kindness of Dr. Seward, and the achenes are as Nees states "matura fere laevis, sordide lutescens, juvenilis cum siccetur subtilissime punctulato-striata pallidiorque."

The type is a small annual closely simulating *E. atropurpurea*, to which it was united by Boeckeler, but is clearly transitional to coarse-rooted perennial plants with identical achenes, such as the collection by León & Roca (no. 6997) figured by Miss Purdy (PL. 3, FIG. 5). The achenes of *E. nigrescens* do not have the consistency in markings found so regularly in species of larger stature, and Clarke's illustration of *E. nigrescens* (Ill. Cyp. t. xxxviii. 1909) was without question a drawing of an immature achene showing a reticulation rarely seen in the more mature achenes of *Wright's* collection (no. 3370 from Cuba), which includes specimens of such variability that the extremes might well be considered as representing entirely different species. Small greenish plants with minute spikelets, fruit-bearing, though often only 1.5 mm. long and 5-6-flowered, intergrade with the larger purplish-scaled material [typical *E. nigrescens*, described by Grisebach from this collection as *Scirpus microlepis*]. These plants no doubt reflect diverse ecological conditions. Though apparently mature, *Ekman* no. 2408^b has lightly reticulate achenes, not costulate and with a depressed style-base. It was correctly determined as *E. nigrescens* by Kükenthal.

Ravenel's little plant from South Carolina, undoubtedly the basis of Britton's citation (Journ. N. Y. Mic. Soc. v. 107. 1889) of *E. bicolor* from South Carolina, "Santee Canal, Ravenel in 1848" was noted by Dr. Small's keen eye as distinct from any other material collected in the United States, and named by him *E. carolina*. It is identical with the larger plants of *Wright* no. 3370.

The African plants which I have included under this species also show variation in the color of spikelets: thus *Chandler* no. 1372, with deep brown scales, is in every respect a good match for the type specimen of *E. nigrescens*, and it grades into the somewhat lighter-scaled plants exemplified by *Perrier de la Bâthie* no. 17947 from Madagascar.¹ *E. Hildebrandtii* Boeckl. and *E. complanata* Boeckl.

¹ I here express my great appreciation to Dr. H. Chermezon of Strasbourg, the distinguished worker on the *Cyperaceae* of Madagascar, for his kindly help, and for an excellent series of specimens of *Eleocharis*.

have identical achenes, as C. B. Clarke long ago noted (Thiselton-Dyer, Fl. Trop. Afr. viii. 409 (1902)), and *E. complanata* (described by Boeckeler as only 2-5½ inches high) cannot greatly exceed *E. Hildebrandtii* in size. However, I may perhaps err in this disposition of *E. complanata*, which in its culms "valde compressis leviterque 3-4 sulcatis" shows an approach to *E. anceps*.

Typical *E. nigrescens* in the New World passes imperceptibly into plants having cylindric spikelets with appressed scales which I treat here as

Var. **minutiflora** (Boeckl.) n. comb. (PL. 462, FIGS. 8, 9). Culms filiform, erect, light green, often with fibrous bases, spongy to quadrangular-sulcate, 4-20 cm. high: sheaths usually marcescent, spikelets many-flowered, greenish, oblong-cylindric to elliptic, 1-3 (rarely 5) mm. long: scales white with a narrow green keel, often chestnuttinged on the sides, acute to obtuse or emarginate, appressed, or sometimes spreading in fruit: achene as in typical *E. nigrescens*.—*E. minutiflora* Boeckl. in Engler, Bot. Jahrb. vii. 274 (1886); Kükenthal in Fedde, Rep. Spec. Nov. xxiii. 194 (1926). *E. microcarpa* C. B. Clarke in Urban, Symb. Ant. ii. 71 (1900); Britton & Wilson, Surv. Porto Rico & Virgin Isl. v.¹ 92 (1923), excl. syn.; not Torr.—West Indies, Yucatan. CUBA:¹ Prov. Santa Clara, at the mines of Motembo, hard somewhat moist soil, *Ekman*, no. 16857 (NY, S); *C. Wright* no. 3766 (G); Arroyo Mateo Sanchez, Pinar del Rio City, *Ekman* no. 17945 (S); *C. Wright* (distributed as *Scirpus paracicularis*) (NY). Sr. THOMAS: in locis humidis gregaria, Krum Bay, Nov. 1881, *Eggers* no. 767 (NY);² *Eggers*, Krum Bay, no. 546 (ISOTYPE, in herb. Calif. Acad. Sci). YUCATAN: south of Villa Hermosa, Campeche, in tinal, *C. L. Lundell* no. 1143, Jan. 8, 1932 (distributed as *E. retroflexa*) (NY).

To Miss Eastwood of the California Academy of Sciences I am much indebted for the opportunity of examining a specimen of *Eggers* no. 546, the TYPE collection of *E. minutiflora*. The plants (5-7 cm. high) are especially characterized by narrow cylindrical green spikelets and somewhat swollen culm-bases, which have a whitened fibrous quality not easily described but perhaps the accumulated debris of basal spikelets or similar sheathing material. *Ekman's* specimens (no. 16857) are still smaller, with culms only 2-3 cm. high. The same plant is represented in a larger and somewhat more flaccid state by

¹ *Ekman* nos. 18979 and 17945 are in addition cited by Kükenthal (l. c.) from Cuba.

² This specimen represents a fragment of the collection in herb. Copenhagen, lent in 1930 by Dr. Ostenfeld to Dr. Britton, who up to the very last, maintained keen interest in the *Cyperaceae* and especially in the genus *Eleocharis*.

C. Wright's no. 3766 (G),¹ in which the culms may range as high as 14 cm. Some of the spikelets are tinged with brown as they are also in Lundell's gigantic specimen. The culms in the last-mentioned plant rise up to 20 cm. high from a ligneous turf-like aggregation of matted rootstocks. The basal scales of the elongated spikelets persist after the other scales have fallen.

Gardner no. 2373 (G) (from Piauihy, Brazil (PL. 461, FIG. 8) distributed as *E. nigrescens*), has larger, rotund, grayish, rather deeply reticulate achenes. Although cited under *E. subfoliata* C. B. Clarke, it obviously does not belong with that species but represents either an extreme development of *E. nigrescens*, or a distinct species. *Löfgren's* no. 453 (distributed as *E. sulcata*) from Ceará, Brazil (US) appears to be the same as *Gardner* no. 2373.

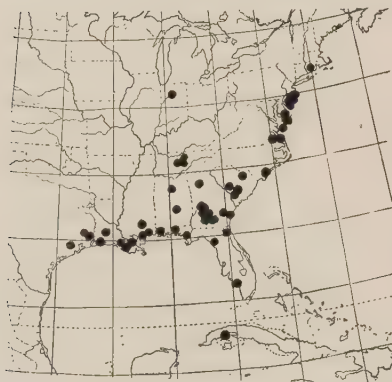
8. *E. SUBCANCELLATA* C. B. Clarke (PL. 461, FIG. 3). Cespitose, the rhizome, when present, white, branched-ascending: culms filiform, green, spongy, lightly punctate, sometimes quadrangular-sulcate, 2–7 cm. long: sheaths green to whitish, usually marcescent, the apex sometimes becoming filiform and divergent: spikelet many-flowered, 2–5 mm. long, scales greenish, keeled, with purplish to chestnut sides; style 3-fid: achene triangular, elliptic to obovate, 0.6–0.8 mm. long, strongly costate with truncate apex, whitish with a pearly lustre, lightly cancellate, with circular pitting: style-base narrow, depressed-apiculate: bristles rudimentary, united to form a cup-like base.—*Kew Bull. Add. Ser.* viii. 21 (1908).—MEXICO: Guadalajara, *Pringle* no. 3430 (TYPE K, NY); muddy places near Guadalajara, *Pringle* no. 7069 (G).

E. subcancellata was described as having culms 2–4 cm. long and spikelets scarcely 2 mm. long, but a fragment of the type sent from Kew to the New York Botanical Garden shows some spikelets approaching 4 mm. in length. This material is identical with the more robust specimen (culms up to 7 cm.; spikelets to 5 mm.) under *Pringle* no. 3430 (NY), a sheet which also includes specimens of *E. minima*. *Pringle* no. 4339 (B, NY) from Guadalajara (issued as *E. subcancellata*) is clearly *E. minima*. *E. subcancellata* is close to *E. nigrescens*, and should perhaps be included under that species.

9. *E. MICROCARPA* Torr. (PL. 460, FIG. 10; PL. 462, FIG. 14): MAP 7. Annual: culms 1–3 dm. high, *finely capillary*: *flexuous*, often quadrangular-sulcate: roots fibrous, white: sheaths inconspicuous, closely investing the culm, purple-striate at base, somewhat acuminate at

¹ This number is not listed in Sauvalle's *Flora Cubana*, but the material is identical with two sheets of the Wright collection (NY) labeled "*Sc. paracicularis*," hence the observation: "*Species H. paraciculari* (Scirpus) Wright proxima" by Boeckeler (l. c.).

apex: spikelets many-flowered, oblong to ovate, 2–7 mm. long: stamens 2 or 3: style 3-fid: scales loose, strongly keeled especially toward the apex, ovate, with a whitish margin, the green midrib bordered by brownish-red, somewhat acuminate, *all deciduous except the enlarged lowest scale which persists as a bract*: achene minute, 0.6–0.7 mm. long, (nearly 0.7 mm. in type), obovate, triangular, grayish-white or yellowish, smooth: *style-base low-conic*, gray, often reddish when young: bristles whitish to light brown, appressed, *less than half the length of*



MAP 7. Range of *ELEOCHARIS MICROCARPA*.

streams, near Acree, Worth County, *Svenson* no. 6963. FLORIDA: Fort Myers, *Standley* no. 14890 (NY); Jacksonville, *Curtiss* nos. 4088 (NY), 4800 (NY) and 5669 (G, NY); Wewahitchka, *Chapman* no. 2300a (G, NY); *Chapman* (NY); *Rugel* no. 279 (NY). MISSISSIPPI: Ocean Springs, *Tracy* no. 101 (NY). LOUISIANA: pine wood ponds on flat and wet glades, Calcasieu River, *Carpenter* no. 36 (NY); Covington, *Arsène* no. 11302 (G); New Orleans, *Ingalls* in 1834 (TYPE, NY). CUBA: road to Coloma, Pinar del Rio, *Ekman* no. 18251 (*E. nigrescens*, det. *Kükenthal*¹) (NY); *C. Wright* no. 3765 (NY) (TYPE coll. of *E. cubensis* Boeckl.) (G, NY). Passing, especially northward, into the

Var. *FILICULMIS* Torr. (PL. 460, FIG. 9). Culms a little thicker, not flexuous: scales spreading, keeled, strongly marked with purple on the sides: achenes 0.7–1 mm. long: style-base conic-pyramidal: bristles opaque, usually equalling the achene.—Ann. Lyc. N. Y. iii. 312 (1836). *E. Torreyana* Boeckl. *Linnaea* xxxvi. 440 (1869–70); Robinson & Fernald in *Gray Man.* ed. 7, 183, fig. 254 (1908); Britton & Brown, *Ill. Fl.* ed. 2, i. 316, fig. 775 (1913); Fernald, *RHODORA* xxxvii. 393 (1935).—Connecticut to Tennessee and Mississippi; also northern Indiana. CONNECTICUT: Voluntown, *C. B. Graves* in 1907 (G). NEW JERSEY: pine barrens, *Austin* (NY); Quaker Bridge, *D. C. Eaton* in

¹ Fedde, Rep. Spec. Nov. xxiii. 194 (1926)

the achene.—Ann. Lyc. N. Y. iii. 312 (1836). *E. cubensis* Boeckl. *Cyp. Nov.* ii. 10 (1890). *E. nigrescens* *Kükenthal* in Fedde, Rep. Spec. Nov. xxiii. 194 (1926) in part.—South Carolina to Louisiana; western Cuba.—SOUTH CAROLINA: ponds, Santee Canal, *Ravenel* (as *E. acicularia*) (NY). GEORGIA: muddy margin of pine-barren pond, Sumter County, *R. M. Harper* no. 550 (NY); Leesburg, *Earle* in 1895 (NY); in bed of a brook, Sycamore, Turner County, *Svenson* no. 7336 (B); gravelly or muddy borders of small

1860 (G, NY); pine barrens, *Torrey* (TYPE, NY); Manahawkin, *Long* in 1909 (G); Egg Harbor, *H. A. Long* in 1905; Bennett, *Gershoy* no. 146 (in part) (G); Bennett, *Van Pelt* in 1908 (Ph); Cold Spring, *Long* no. 5709 (Ph); Winslow Junction, *Mackenzie* in 1921 (NY); Egg Harbor City, *Van Pelt* in 1906 (NY) and *Mackenzie* no. 5564 (NY); bogs near Bennett, *Mackenzie* no. 6564 (NY); Dennisville, *Mackenzie* in 1921 (NY); Woodbine, *Pennell* in 1906 (NY). DELAWARE: Ellendale, *Canby* (NY); Milton, *Britton* (NY); Pepper's Mill, Laurel, *Commons* (NY). MARYLAND: Salisbury, *Commons* (NY). VIRGINIA: wet peaty depressions in sandy pineland, Cape Henry, *Fernald & Long* no. 3761 (G). NORTH CAROLINA: Wilmington, *Canby* (NY); *M. A. Curtis* (two sheets, NY). SOUTH CAROLINA: Barnwell District, *Ravenel* (NY); Aiken, *Ravenel* in 1872 (NY); ditches in the low country, *M. A. Curtis* (NY); Hartsville, *W. C. Coker* (NY); *Elliott*, herb. Le Roy (NY). GEORGIA: Jesup, Wayne County, *Curtiss* nos. 3083 (G, NY), 6841 (NY); Leslie, Sumter County, *R. M. Harper* no. 421 (NY); shallow clear water, Muckalee Creek, Sumter County, *R. M. Harper* no. 533 (NY); shallow pools in granite quarries, Little Stone Mt., Dekalb County, *Svenson* no. 7505 (B). FLORIDA: *Chapman* (NY); De Funiack Springs, *Curtiss* no. 5927 (G, NY); *Buckley* in 1839 (NY). INDIANA: dry sandy roadside ditch, 2 miles S. E. of Tefft, Jasper County, *C. C. Deam* no. 46420 (D, G). TENNESSEE: in a dried-out bog, east of Altamont, Grundy County, *Svenson* no. 7337 (B); swamps and roadside pools, south of Jamestown, Fentress County, *Svenson* no. 7065 (B); muddy margin of a pond, Crossville, Cumberland County, *Svenson* no. 6912a (B). ALABAMA: Mobile, *Mohr* in 1868 (NY) and 1884 (NY); Cullman County, *Eggert* in 1897 (NY); Montgomery, *McCarthy* in 1888 (NY); De Soto Falls, *Ruth* no. 124 (NY). MISSISSIPPI: Biloxi, *Tracy* no. 3592 (NY).

Professor Fernald has pointed out (l. c.) that there is no specific distinction between *E. microcarpa* and *E. Torreyana*, and detailed study of these plants over a period of years has brought me to the same conclusion. There is, however, a marked difference in external appearance, typical *E. microcarpa* having culms as fine and flexuous as in the slenderest examples of *E. acicularis*, while the var. *fliculmis* has noticeably thicker and stiffer culms, giving the plants a strict and rigid appearance. The achenes of the two varieties show well-marked and fairly constant differences in size (achenes of the type collection of *E. microcarpa* average just under 0.7 mm.; those of the type of var. *fliculmis* average 0.8 mm. long), also in length of bristles and acuteness of the tubercle, but the color of scales seems to be of little importance. Though the var. *fliculmis* is the sole representative in the northern area, it infiltrates to some extent throughout the range of the species; whereas typical *E. microcarpa* is still unknown to me from

E. Lundellii Svensen, *Am. Midl. Nat.* 29: 470-1
fig. 2, 1943. Texas. closest to *E. microcarpa* v. *Brittonii*

north of South Carolina. The collection (*Fernald & Long* no. 3761), cited from Virginia,¹ with achenes averaging 0.8 mm. long, bristles equalling the achene, and culms thick and rigid, would seem to me rather to belong with the var. *fili culmis*. Closely linked with *E. microcarpa* is a usually much taller plant with appressed whitened scales, and greenish-gray achenes with a depressed style-base, which may be called

Var. **Brittonii** n. comb. (PL. 460, FIG. 11). Culmis strictis, 1.5-10 dm. altis; squamis adpressis, obtusis, haud carinatis, albidis vel leviter brunneo-variegatis: achenio pyriformi, 0.6-0.8 mm. longo, ad basin valde contracto, obscure trigono, viridescenti-griseo, obscure reticulato, interdum atro-punctato: stylobasi depressa apiculata: setis brevibus frequenter translucentibus.—*E. Brittonii* Svensen ex Small, *Man.* 164 (1933). *E. tenuis* Schultes var. β Torr. *Ann. Lyc. N. Y.* iii. 310 (1836). *E. prolifera* Torr. *Ann. Lyc. N. Y.* iii. 315, 442 (1836), in part, especially p. 442. *E. microcarpa* Boeckl. *Linnaea* xxxvi. 439 (1869-70), e descr.—New Jersey to Louisiana and Texas. NEW JERSEY: Bennett, *Gershoy* no. 146 (in part) (G); *Long* no. 5120 (Ph), and O. H. Brown in 1915 (Ph). GEORGIA: Leesburg, *Earle* in 1895 (NY); moist pine barrens, Alapaha, *Curtiss* no. 6821 (G, NY); moist pine barrens, Sumter County, *R. M. Harper* no. 639 (G, NY); Leslie, Sumter County, *R. M. Harper* no. 407 (G); Darien Junction, McIntosh County, *Small* in 1895 (NY); in bed of a brook, Sycamore, Turner County, *Svenson* nos. 7332, (B), 7333 (B); mucky depressions in pine barrens, east of Sycamore, *Svenson* no. 7334 (B). FLORIDA: Cross City, *Small, DeWinkler & Mosier* no. 11318 (NY); *Chapman, Eleocharis* sp. no. 3 (NY); Middle Florida, *Chapman* (as *E. prolifera*) (NY). ALABAMA: miry borders of ponds, ditches, Mobile, *Mohr* in 1895 (as *E. vivipara* Kunth) (NY); Mobile, *Sullivant* in 1848 (G). MISSISSIPPI: Augusta, *Tracy* no. 3406 (NY). LOUISIANA: moist pine land, Saint Tammany Parish, Abita Springs, *Pennell* no. 4199a (NY); New Orleans, *Ingalls* (TYPE, NY; type also of *E. tenuis* var. β Torr.) (NY); Covington, *Arsène* no. 12183 (NY); Tiger's Pt., W. La., *Langlois* in 1886 (NY); shallow ponds, pine woods, *Hale* no. 31 (G, NY). TEXAS: wet prairies, Houston, *E. Hall* no. 697 (June 12, 1872) (G, Ph, NY, Pom); *T. W. Thurow* in 1899 (NY); Corrigan, *Plank* in 1894 (NY); prairie near Indianola, *Ravenel* no. 95 (NY); Jasper County, *C. Wright* no. 125 (G).

This remarkable plant has the general appearance of a coarse extreme of var. *fili culmis*, but with flat scales usually of much lighter color, that remain appressed to the axis of the spikelet. In well-developed specimens, the pyriform obscurely-angled achene is a beautiful greenish gray (approximately *Court Gray* of *Ridgway*) with

¹ RHODORA xxxvii. 394. (1935).

rather clear reticulation and a flattened apiculate style-base, and with translucent bristles rarely exceeding half the length of the achene. Until I saw this plant growing with typical *E. microcarpa* in the long-leaf pine area of southwestern Georgia, I believed it to be a well-marked species. From robust specimens (such as *Harper* no. 639) with achenes up to 0.8 mm. long, the variety passes into the dwarf wiry plants (notably in Texas collections, cf. *E. Hall* no. 697) with brownish scales and slightly angular, often yellowish-speckled, achenes which are only 0.6 mm. long. The type of *E. tenuis* var. β Torrey, overlooked for so many years, is a large specimen closely resembling *Harper* no. 639; and here also, judging from Boeckeler's description, belongs *Drummond* no. 407 from New Orleans.

(to be continued)

NEW STATION OF *OXALIS MONTANA*, FORMA *RHODANTHA*.—While hiking the trail from the Town of Warren, New Hampshire, to the Three Ponds last June, I had the good fortune to discover a small colony of *Oxalis montana*, forma *rhodantha* Fernald. This plant appears to be locally distributed in the White Mountains and neighboring region. It has been collected at Chesterville, Maine, (*Miss Eaton*); Manchester, Vermont, (*Grout*); White Mountain Notch (*C. E. Faxon*); Mt. Adams, New Hampshire (*Schweinfurth and St. John* in 1911); and Eden, Lamoille County, Vermont (*C. H. Knowlton*).

This new colony, not exceeding one hundred plants, grows along the trail in a sphagnous depression on Mt. Carr, Warren, New Hampshire ($43^{\circ} 55' 18''$ N, $71^{\circ} 50' 6''$ W.) at an elevation of two thousand feet.

A few plants associated with this colony of *Oxalis* are: *Clintonia borealis*, *Coptis trifolia* and *Chiogenes hispidula*. Near it grow such trees as *Picea rubra*, *Abies balsamea*, *Betula lutea* and *Acer saccharum*. The species, although appearing nearby, seems not to mingle with its variety.

Specimens in my herbarium were verified as to their identification by Dr. O. E. Jennings and Dr. E. H. Graham of the Carnegie Museum Herbarium at Pittsburgh, Pennsylvania.—JOHN A. CHURCHILL, Pittsburgh, Pennsylvania.

CLADIUM MARISCOIDES IN SASKATCHEWAN.—A specimen recently received from Professor W. P. Fraser of the University of Saskatchewan, Saskatoon, for determination proved to be *Cladium mariscoides* (Muhl.) Torr. and seems worthy of note as representing a considerable northwestward extension of the known range of this sedge. The collection was made by A. J. Breitung, July 19, 1936, in a bog at Dahltown (about 150 miles northeast of Saskatoon), Saskatchewan. The westernmost Canadian stations recorded by Macoun (Catalogue of Canadian Plants, 2 (part 4): 108. 1888.) for the plant are Muskoka County and Point Edward (Lambton W. County), Ontario. In current manuals the species is generally represented as attaining the western limit of its range in Minnesota and, although MacMillan (Metaspermae of the Minnesota Valley, 104. 1892.) doubted the reliability of the early Minnesota reports, Professor C. O. Rosendahl informs me that he has himself collected it in the bottomlands of the Minnesota River about ten miles southwest of Minneapolis. The Dahltown, Saskatchewan, station is slightly over 800 miles northwest of this Minnesota station. In Michigan *Cladium* occurs approximately 200 miles farther north (Eagle Harbor, Keweenaw County, *F. J. Hermann* no. 8193, in Herbarium of the New York Botanical Garden)¹ than at Professor Rosendahl's locality, but this station is 200 miles farther east so that the "distance record" of Mr. Breitung's collection is not affected by it.—F. J. HERMANN, University of Michigan.

¹ Beal (Michigan Flora, 53. 1904) reported it as known only from the Lower Peninsula and presumably this was true at the time of publication of his "Additions" (Tenth Ann. Rep. Mich. Acad. Sci. 1908), but subsequently Dodge found it in the Upper Peninsula in Schoolcraft and Chippewa Counties (Publ. 31, Biol. Ser. 6, Mich. Geol. and Biol. Surv. 1921).

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